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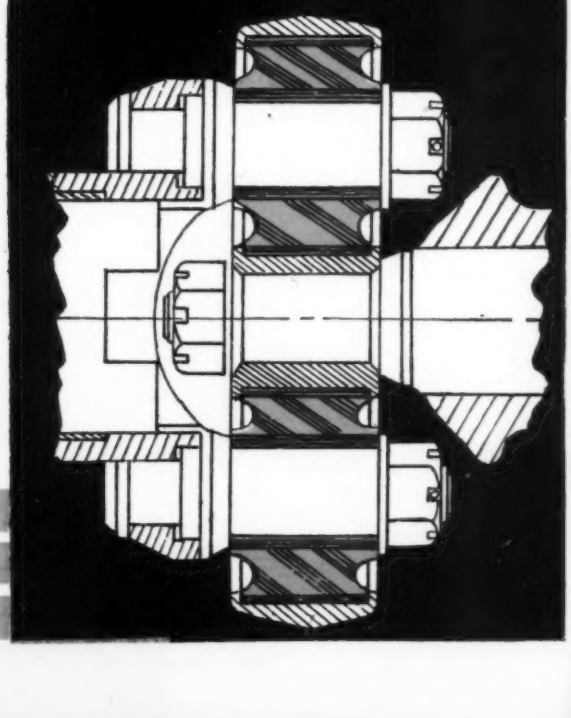

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The Outlook

An Elusive Ideal

SUGGESTIONS for post-war air transport designs nearly always include tailless types. It is very natural that this should be so. Superficially the tailless is undoubtedly "clean," and as the authors of an article in this issue point out, the rear portion of a fuselage cannot in any case be used for housing heavy loads, owing to the need for keeping the centre of gravity of the aircraft in its proper place.

The idea of tailless aircraft is, of course, almost as old as flying itself. Professor Hugo Junkers visualised it in about 1909, and, indeed, took out patents on what he termed a *Nurflügel* (all-wing) design. But in those days we did not know a great deal about stability, the most delicate aspect of tailless design. There were exceptions, of course. For example, Col. J. W. Dunne, who in more recent years has occupied himself with the even more complicated subject of relativity, realised the advantages and disadvantages of the tailless type. He foresaw that to get longitudinal stability it was necessary to sweep back the wings sharply so as to get the wing-tip control surfaces (they were elevators and ailerons combined) well aft of the centre of gravity, thus giving them a reasonable "lever arm" to work upon. That was in 1910-11-12.

Later, in fact during the years between the wars, Captain Geoffrey Hill revived the tailless ideal with his Pterodactyls. In them the sweep-back was rather less pronounced than in the Dunne, but still fairly considerable. Shortly before the outbreak of the present war Handley Page was experimenting with a tailless design, of which a flying scale model was built but not, so far as we know, ever flown. Still more recently Jack Northrop has built a flying scale model in California. It underwent many modifications, notably to its wing tips, and the sweep-back in this type was relatively slight.

The point to note here is that the natural process of evolution of the tailless appears to have been towards nearly straight wings, with the elevator control surfaces working on a very short lever arm. In one of the designs in this issue this lever arm has become very short indeed (the technicians talk of control surface "volume," which is meant to convey the product of area and lever arm), and one wonders how the designers expect to obtain not only control but stability. Both must be achieved, for an aircraft of this size which was controllable but unstable would be a dangerous proposition, and one that was stable but uncontrollable would be little better.

Stability and Control

QUITE early in the history of flying it was discovered that a wing section could be made inherently stable by reflexing (that is to say, upturning) its trailing edge. That was in the days before the discovery of the split trailing-edge flap, and it was found that the maximum lift coefficient was rather disappointingly low. Split or slotted flaps can be made to restore the lift, but probably not in conjunction with a trailing-edge reflexed sufficiently to give the desired longitudinal stability.

Directional stability is another difficulty. Col. Dunne used large fins and rudders at the wing tips. His example was largely followed by Hill. Northrop tried other means; he tilted the wing tips down at a sharp angle. Insufficient information has been published to enable one to know whether the tilted Northrop tips worked in the way they were intended to work. Those of the six-engined design by Pollitt and Laver in this issue appear totally inadequate, especially in view of the

possibility of one of the outboard engines cutting out.

We are strongly in favour of taking the long view in the matter of post-war aircraft, but we feel that a great deal of research and experiment would be necessary before the design of a large tailless could be undertaken with any degree of confidence in the result.

Inept Bureaucracy

THAT civil aviation should be taken away from the Air Ministry is an argument which has been put forward on many occasions. The idea is not new; in fact, it has been cropping up on and off for the last twenty years or so. In the early days *Flight* opposed that policy. We felt that civil aviation, and more specifically commercial aviation as it was then called (although "commercial" was rather a misnomer), was taking its first faltering steps and needed all the help and guidance which the Air Ministry, as the Government department charged with air development, could give it.

Circumstances have changed, and the Air Ministry has other preoccupations. That it really cannot give proper attention to the question of civil air transport was very clearly demonstrated in the House of Commons the other day, when the Air Minister was tackled about the new board of directors of the British Overseas Airways Corporation. He had to admit that all the new directors, including the chairman, were on a part-time basis and that only one of them receives remuneration.

We hold no brief for the Corporation. In fact, we are aware, as are large sections of the community, that for some years past it has not been a "happy ship," and that there was a great deal of cleaning up to be done before it could function with full efficiency. But it must be admitted in all fairness that the Corporation has had an extremely difficult task.

Whether or not the directors of the Corporation were right in their refusal to continue under the new arrangement with the R.A.F. Air Transport Command is, perhaps, open to debate. There is a good deal to be said on both sides of the argument. But that the Corporation could be expected to work efficiently under a board of unpaid part-time directors, none of whom has any experience of air transport, is unthinkable.

If the Government intends to kill the Corporation, let it say so frankly. It might well be better to do so and start afresh after the war. But if it is intended to keep it working efficiently, with a view to making full use of it after the war, the Air Ministry will have to put the direction in better order than it seems inclined to do at the moment.

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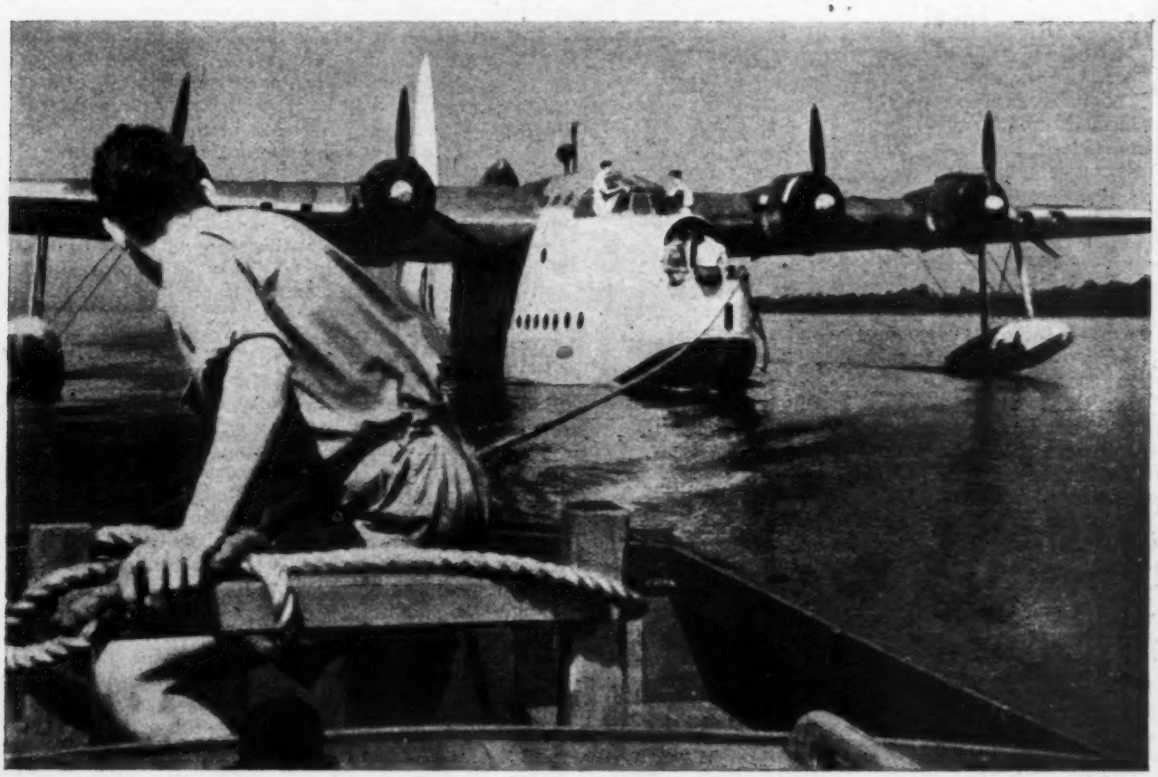


SUNDERLAND III: The first published photograph of a Sunderland flying boat with a streamlined, power-operated, turret in place of the two open gun positions amidships. The Sunderland is being towed into a West African creek after patrol.

WAR in the AIR

Australian reinforcements arrive by air at Wau Airfield in New Guinea.

The Akarit Victory : New Tactics by MacArthur's Fortresses : Great Air Battle Over Guadalcanal

GENERAL MONTGOMERY is skilful at varying his tactics, and at springing surprises on Rommel by so doing. From Alamein to El Hamma he took his time in marshalling his forces before he attacked, and made the Germans think that he would always do the same. But at the Wadi Akarit he took only a week to prepare for the assault, and Rommel evidently did not expect it so soon. Then he chose a moonless night and launched his attack at 4 a.m., which was another surprise. At the battle of El Hamma he gained his rapid victory by a novel use of aircraft (not yet completely explained), and used them to blast a way through German defences when the difficult state of the roads had prevented enough guns arriving at the battle area to do what is normally their proper job. In the darkness at Akarit it was naturally impossible for his aircraft to do much, so he trusted to his great strength in artillery—another example of resource which baffled Rommel. None the less, the reports indicate that air reconnaissance played a vital part (as it must always do) in preparing the plans for the attack, and it also seems likely that air reconnaissance, by means of flares, was able to report the results of the artillery bombardment and so determine the moment when the barrage should shift from one point to another. The result has been a victory which should go far to shatter Rommel's reputation. He has been not only outnumbered but out-generalled by a better man.

FIELD SERVICE : American engineers repairing a Fortress which had been damaged by flak, and had forced-landed in England. The portable sheer-legs for lifting engines in and out are of interest.

Although the battle of Akarit was a triumph of artillery and infantry, the United Nations Air Forces showed a maximum of energy in seeing to it that the Axis squadrons should do nothing to restore the German and Italian position. In North Africa, under General Spaatz, the Air Force has now been divided into three, denominated the North-West African Tactical Air Force (under Air Vice-Marshal Coningham), the Strategic Air Force (under Major General Dolittle), and the Coastal Air Force, while the contingent which has accompanied the Eighth Army continues to be known as the Western Desert Air Force, and is under Air Vice-Marshal Broadhurst. Of course, we cannot say whether the grouping of the first three bodies in this way has been done by General Spaatz or by Air Chief Marshal Tedder. The latter has strategical control over all the Air Forces in the Mediterranean from Morocco to Egypt, with three local

ENEMY AIR LOSSES to APRIL 10th

		Over G.B.	Over Continent	Middle East
April	4	0	11	0
"	5	0	3	0
"	6	1	0	1
"	7	3	0	0
"	8	0	0	0
"	9	1	5	2
"	10	0	2	0
		5	21	3

Totals: West, 6,779; Middle East, over 5,274; North Africa, 1,192.

commanders under him, namely, General Spaatz, Air Vice-Marshal Sir Keith Park at Malta, and Air Chief Marshal Sir Sholto Douglas at Cairo. Now that the Eighth Army has established contact with the forces of General Eisenhower, it is possible that there may be some reorganisation of the Air Forces. The present arrangement provides that the Tactical Air Force helps in the Tunisian fighting outside the area of the Western Desert Air Force, while the Strategic Air Force carries the war into the Italian islands and Europe and interferes with Axis supplies to Tunisia.

One must admit that Rommel shows great ability in getting out of tight corners, but as he retreats the whole Axis area in Tunisia contracts, and this condenses the targets at which the various branches of the Allied Air Forces can strike. The hasty retreat has cost the Axis great quantities of material, and intensive efforts have been made to replenish some of this by flying stores of petrol and other stuff across from Sicily. At these flying convoys the Allied aircraft have been hitting hard. On one day last week they shot down 18 transport machines and 13 others. On another day Lightning fighters met an air convoy and destroyed 30 Ju 52 transports and 11 others, while later on the same day Mitchell light bombers found another convoy and attacked it, destroying 10 Ju 52s and two Ju 88s.

There has been much speculation as to whether the Italian fleet would risk a naval battle in order to make possible the evacuation of Tunisia by the Axis armies on the lines of Dunkerque. The probability of that was reduced by a heavy raid of Fortresses on the harbour of Maddalena in Northern Sardinia. It was claimed that two Italian 10,000-ton cruisers, the *Trieste* and the *Gorizia*, were hit by bombs, and that the *Trieste* afterwards sank.

WAR IN THE AIR

There has also been raids on Naples and Messina.

In the Pacific

A LARGE concentration of Japanese shipping at Kavieng harbour in the island of New Ireland was destroyed or dispersed by American aircraft not long ago. It was stated that new tactics were employed in this raid, which consisted, partly at any rate, in very low flying by Fortresses. These machines were designed for high-altitude work, and it is strange to read of them coming in to attack at mast-high altitude. It seems that some of the story has not yet been told, but, at any rate, the raid was very effective, and achieved its purpose.

In New Guinea the Japanese have now established their main base at a place called Wewak, and this has been daringly raided by Gen. MacArthur's bombers, though each raid has entailed a very long flight from base. The yellow men have also tried to be aggressive in the air, and not long ago sent a strong formation over Guadalcanal, consisting of 50 bombers with an escort of 48 Zero fighters. The bombers included a number of dive-bombers. A tremendous air fight ensued, in which the Americans scored heavily, and shot down 39 of the enemy machines.

The Zero fighter had the best of the American Buffalo in the Malayan campaign, but since then things have changed. The Americans have sent over vastly improved fighters, while the Japanese still stick to the Zero. They may have modified it and tried to improve it; of that no definite news has come through, but it is clearly outclassed by the Lightnings and other American machines of modern design.

In Burma, too, the R.A.F. Hurricanes seem to find no difficulty in geting the better of the Zeros, and this is just as well, for the land fighting there has not been going too well for the British and Indian troops, though in the air the R.A.F. and the Americans are easily in the ascendant. In jungle fighting, however, aircraft cannot play much part. Their efforts have to be directed against lines of communication by river, road and rail, and against positions in the open.

BRITISH & U.S. AIR LOSSES to APRIL 10th

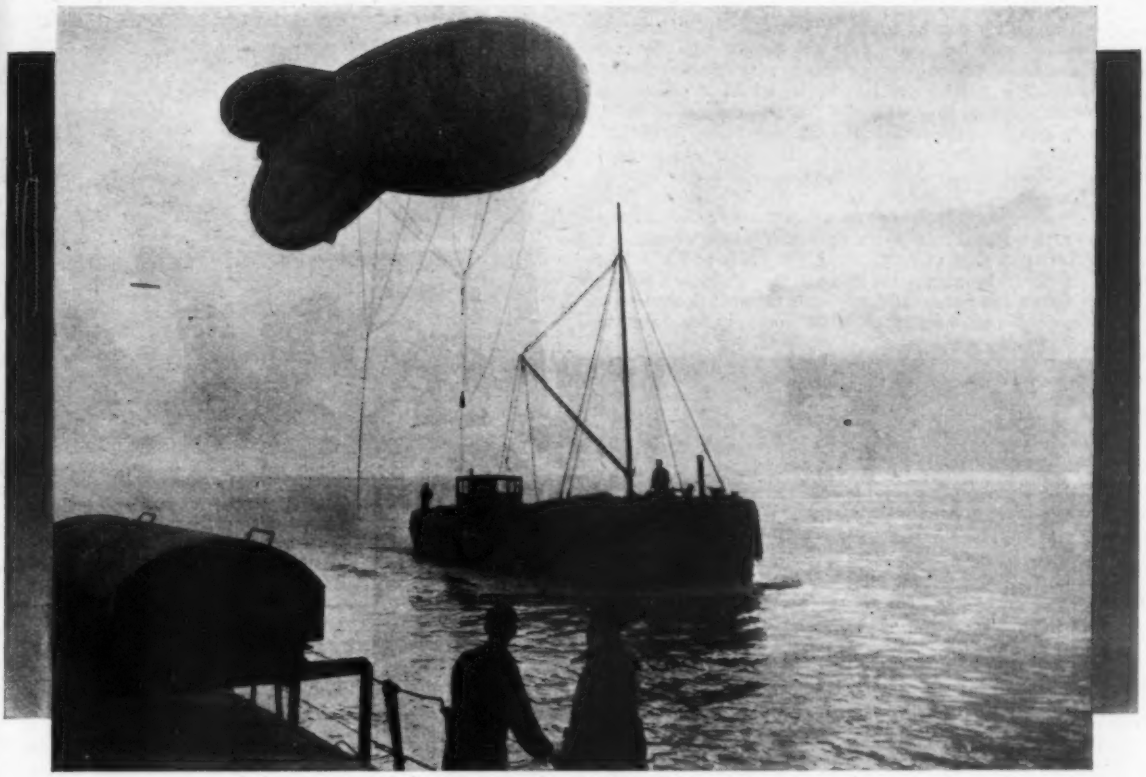
		Over G.B. A'crft.	Over Continent B'brs.	Over Continent F'trs.	Middle East A'crft.
April	4	0	19	12	0
"	5	0	7	2	0
"	6	0	2	1	0
"	7	0	0	0	0
"	8	0	21	2	0
"	9	0	10	0	0
"	10	0	19	6	0
		0	78	23	0

Totals: West, 5,614; Middle East, about 2,086; North Africa, 468.

The Western Front

THE activities of the operational Commands in Great Britain are now so frequent and so widespread that it is hard to keep track of them all. Krupps' works and Essen generally have evidently been put out of action for some time to come, though the German capacity for effecting speedy repairs and getting factories working again is not less than British abilities in the same line. The German armaments chief, Speer by name, recently said that, despite the R.A.F. raids, there had been no interruption in the sending of weapons to the front, and this is believed to be true. The enemy accumulated large stores of arms of all sorts before Bomber Command was strong enough to interfere very much with their production, and these formed a strategic reserve. The presumption is that this reserve is being drawn on now. It was meant to meet such an emergency, but it cannot last for ever, and in the meantime the depredations of Bomber Command are growing in strength. If the war lasts long enough, the German armies must sooner or later feel the pinch.

SCRAP FROM SCRAPS: Macchi 200s, Fiat G.50s and C.R.42s in various stages of destruction at Castel Benito. A number have been repaired and flown for experimental purposes.



A supply barge approaching a moored drifter with a replacement balloon.

Water-borne Balloons

Unsung Heroes of the Coastal Barrage : Constant Vigil and Few Amenities : Many Victorious Encounters with Enemy Aircraft

By N. D. RYDER

THERE have been a number of letters in the Correspondence columns of *Flight* recently on the subject of "Unsung Worthies" of the R.A.F.—those hard-working and skilfully efficient maintenance crews, flight mechanics, armourers and other technicians who comprise the ground staff on operational and training stations, but who get very little publicity.

Equally deserving of the credit they rarely receive are the men who handle the water-borne barrage balloons in the harbours and estuaries around the frontier coasts of Great Britain. Living in a barge, or converted drifter, theirs is a very different lot from that of the worthies, unsung or otherwise, who enjoy the many amenities of a station ashore and several free evenings a week

(Left) Transferring the balloon from the supply barge ; the man on the left is holding the topping-up pipe. (Right) The intent attitude of the winch driver indicates the skill and care required.

in which to visit a nearby town. Theoretically, of course, these water-borne balloon crews get the normal Service leave and passes, but in practice this is very often modified by the weather or the special exigencies of the Service. Their chief physical link with the shore is the ration boat, but even in the summer months bad weather sometimes delays its visits for several days; in winter this often happens, which means delay in the delivery and collection of mail as well as postponed leave.

Bad weather is, in fact, a particular enemy of the balloon barge and its R.A.F. crew for several reasons even more unpleasant than that of postponing the visits of the ration boat. It must be remembered that the majority of the balloon crews are complete land-lubbers until posted to a water-borne "site"—most of them have never been to

(Above) "Over to you." A radio telephonist aboard the water-borne balloon site receives instructions from the shore control—or it might even be a birthday greeting for one of the crew!

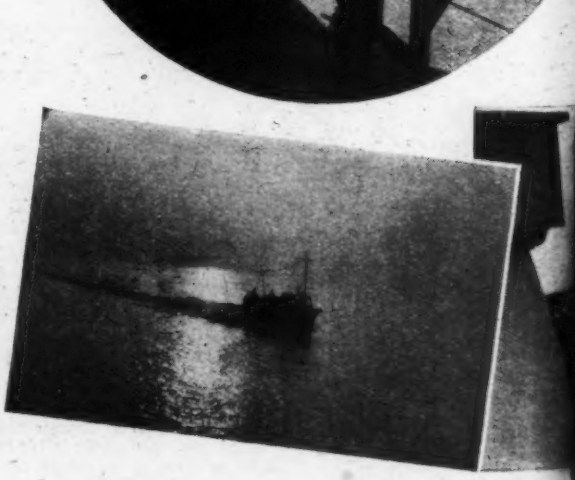
(Above) The operations desk at the shore control from which instructions are sent out to the balloon barges. (Right) A corporal gunner checks his 0.303in. Vickers machine gun.

WATER-BORNE BALLOONS

sea before in their lives—and not only are the barges small craft, but they are frequently moored well out in the mouth of the estuary where it meets the open sea and where the water is particularly rough in bad weather. No land-lubber who knows himself to be a "bad sailor" will need further elaboration on this uncomfortable point, but even when the sufferer has at last got his sea legs his difficulties are by no means at an end. For these small craft are thrown about alarmingly in a rough sea and the men's work is made decidedly hazardous; injuries from this cause are by no means unknown—and there is still the enemy raider, the coastal "hit-and-run" fighter-bomber, with which to contend.

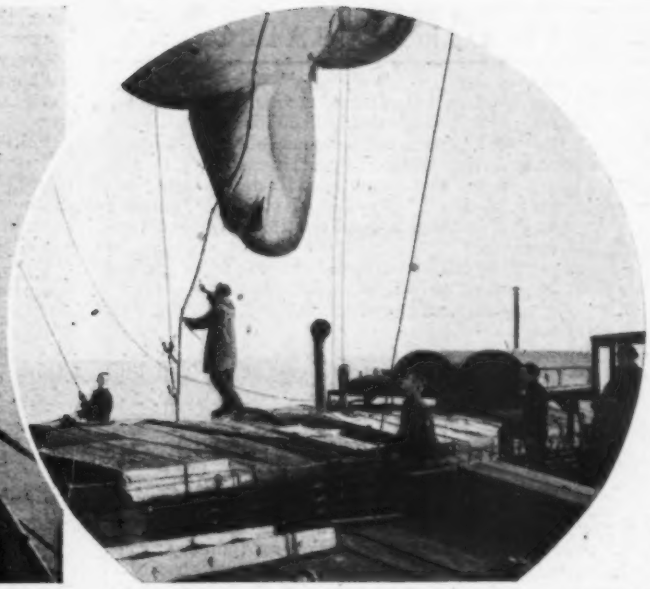
Sailors and Airmen

The personnel of a balloon barge is composed of men of the Merchant Navy, who are responsible for the handling of the craft itself, and the R.A.F. balloon crew, who also man the Vickers machine-guns when enemy aircraft attack their charge, a contingency against which they must be constantly on the alert. Manipulating the water-borne balloon calls for considerably more care and skill on the part of the winch operator than does the same job ashore, because if it is allowed to yaw appreciably when being pulled down or let up, it may well foul a mast, with disastrous results. For the most part, shore barrages are



(Bottom, from left to right) 1. The ration boat, which is also postman, is always a welcome visitor. 2. Model-making is a popular hobby. 3. Pay-parade aboard the balloon barge. 4. The man on the left appears to be threading a left-handed needle, while the other tackles his correspondence.

teries of hydrogen cylinders are maintained on the balloon barges topping-up the balloons when necessary. Here an aircraftman is checking the pressure.



Transferring a balloon from the supply barge is quite a skilled operation. Note the feed pipe by which gas lost through seepage is made good at intervals.

comparatively free from immediate obstructions, and any obstruction that may occasionally exist is at least stationary; only when the sea is perfectly calm is a ship's mast stationary, and when the water is at all rough its tip sways to and fro through a considerable arc. So not only is there always a fairly high obstruction within fouling distance of the cable, but that obstruction is itself often swinging about—just to make life more difficult.

In fine weather, however, when all goes well and enemy aircraft are not making a nuisance of themselves, life on the balloon barge can become decidedly monotonous. As has already been remarked, the tiny floating "site" contains no cinema and it isn't even possible to go for a nice long walk in one's off-duty hours. Fishing, however, is readily available, and in the summer it is no trouble at all to get a swim as often as one feels like it; but, apart from these seasonable outdoor sports, the most popular pastime (apart from reading and writing letters) is model making. Those whose talents lie in the direction of drawing and painting have plenty of time in which to indulge their artistic tendencies, and it will be remembered that a few months ago Balloon Command staged at the National Gallery a very fine exhibition of pictures and models produced by its personnel; a large proportion of these exhibits came from men of the water-borne balloon barrages.

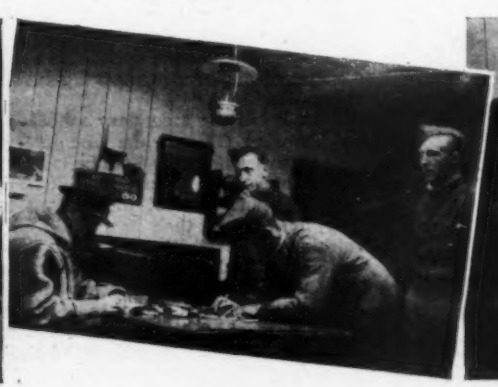
More than 200,000 persons visited this exhibition, and it raised over £2,000 for the R.A.F. Benevolent Fund.

Even at the quietest of times, however, a balloon needs a certain amount of attention from its crew. Gas is lost by slow seepage and must be replaced periodically from hydrogen cylinders with which every barge is kept adequately supplied. This topping-up process is, again, not quite so simple in the case of the water-borne balloon as it is on land, because the balloon cannot be bedded down on a ship. Water-borne balloons are therefore equipped with a special feed pipe, made of stout rubber hosing tough enough to stand up to the most rigorous conditions, and long enough to reach down to the source of supply when the winch driver has manœuvred the balloon from its operational height down to "nought feet."

Replacements

Obviously it is not possible to deal with any actual defect in a balloon from the deck of its barge, so that when any attention beyond the routine topping-up is required, the defect is reported to the shore control by R/T. In due course a supply boat appears, bearing a replacement balloon. The defective one is taken away and, after being overhauled and rendered once more fit for service, will eventually find its way back to sea again to replace some other balloon in need of slight repair.

Occasionally, of course, it is not just a case of a minor repair, but of total destruction, due either to abnormal weather conditions or to enemy action. Enemy raiders



WATER-BORNE BALLOONS

intent on attacking an outgoing or incoming convoy may try to clear a path through the balloon barrage off some estuary, attacking not only the balloons, but bombing and shooting-up the barges themselves; such an attack is very well portrayed in the film produced with the help of Balloon Command, entitled "Operational Height," and is a far more frequent incident around our frontier coasts than many people realise.

But the crews of the water-borne balloons have given a very good account of themselves against this kind of attack and many enemy aircraft have been brought down by their R.A.F. gunners.

But for the balloons, the enemy would be able to release mines at the low altitude of 500ft. to 1,000ft., and thus place them with considerable accuracy. Forcing him to release them at much greater altitude impairs his accuracy.

Every day a senior officer makes a tour of inspection of balloon barges under his command, but the most popular visitor, next to the ever-welcome ration boat, is the officer who visits them to hold the regular pay parade—weather permitting, of course.

That life on a balloon barge can be quite pleasant, incidentally, is shown by the fact that short periods of leave during fine summer weather are sometimes spent afloat, swimming, sunbathing on the deck, and fishing with the aid of the skipper's dinghy.

W.A.A.F. personnel also play their part in helping to keep the water-borne balloon barrages aloft, though they do not serve afloat. Their duties ashore, however, are hardly less important and include jobs connected with servicing the barges and drifters, such as checking and packing supplies for the ration boats and in the control room.

Training for a Career

By L. C. JARMAN, A.M.I.E.E.

IN recent months there have been many articles written on training and technical education for industry; some have dealt with the training establishments already in existence, both inside the industry and under the Board of Education, whilst others have discussed the academic and practical qualifications of an engineer. These discussions, however, tend to relate to an engineer who has served his apprenticeship and is endeavouring to establish himself in industry.

But what of the qualifications required by the *prospective* apprentice? Technical training is becoming more and more a compulsory part of apprenticeship, yet few lads deliberately prepare themselves for technical training between the time they leave school and enter industry. Scondary-school lads are inclined to believe that their school-leaving certificate covers all the subjects they will require to earn a living—a blind faith in the educational system under which they study. Would that this were so! I should like, therefore, to give some guidance to the lad who contemplates entering the engineering industry and, perhaps more particularly, to his father.

The aim of every apprentice should be to hold the Higher National Certificate in Engineering by the time he is 21. Theoretically, an apprenticeship commences at 16 years and terminates on the 21st birthday. Concurrent with this 5-years' apprenticeship is the National Certificate Course, consisting of five sessions, S.1, S.2, S.3, A.1 and A.2. On passing the S.3 examination a student is awarded the Ordinary National Certificate, and the Higher National on completion of the course. This latter certificate is usually recognised by the various engineering institutions as exempting the holder from part of their own respective qualifying examinations. Some institutions include a language in their examinations, a point which is not generally realised by the elementary schoolboy until he makes application to the institution for entry.

Pre-apprenticeship Study

Experience has proved that the elementary schoolboy, leaving school at 14 years, is not capable of tackling the S.1 course when he starts his apprenticeship unless he has been studying during those two years between the age of 14 and 16. There are, therefore, two preparatory senior technical courses (J.1 and J.2) to enable boys to introduce themselves to technical engineering before starting in the industry proper.

The subjects taken in the Junior Technical Course are: Mathematics, Engineering Science and Engineering Drawing. Subjects for the Ordinary National Certificate are:—

S.1. Mathematics.
Engineering Drawing.
Engineering Science (General).

S.2. Mathematics.
Engineering Science (Mechanical/Electrical).
Engineering Drawing.

S.3. Mathematics.
Two other subjects relating to the particular industry in which the apprentice is working. It should be noted that Jig and Tool Drawing and Workshop Technology may be taken by these Students engaged on Production Engineering.

It should be recognised that technical training in a firm's instructional school, as against that in a technical college, is related much more closely to actual manufacturing processes.

If, of course, an apprentice has not attended the preparatory classes, he will attend these at the commencement of his apprenticeship, starting with J.1 or J.2, according to his ability; he should then have his Ordinary National Certificate before he is 21. Technical study does not automatically terminate with the completion of apprenticeship, and failure to make the grade on the technical work does not necessarily terminate the apprenticeship agreement.

Secondary-school Entrants

A secondary-school lad sitting for his school certificate at 16 or early 17 years will be accepted as an apprentice up to 17 years 3 months. Lads in this category are able to cope with the second senior year (S.2) mathematics and science, but it is usually found that they have done little or no engineering drawing. This will relegate them to the S.1 class, since S.1 engineering drawing must be taken in order to qualify for the National Certificate.

Engineering Drawing is essentially the language of the engineer, and although finally it is simply a matter of putting lines on paper, knowing just where to put these lines is the culmination of long hours of study in mathematics, applied mechanics, experience in machine-shop practice, and a general knowledge, derived from the study of the various technical periodicals, of the devices used in up-to-date engineering practice. It is an advantage, then, for the secondary-school lad to get hold of the fundamentals of engineering drawing before he commences his apprenticeship.

Most lads from secondary schools state a preference for the Drawing Office when first interviewed. This is no doubt because (a) they hold certain academic qualifications which show that they are capable of appreciating technical theory; (b) they want (or perhaps their parents want it so as not to upset their own established routine) the shorter working hours which obtain for "staff" personnel; and (c) they do not wish to work in overalls on a job which, they are persuaded, is "below their station." It can be said without hesitation that to be successful a draughtsman/designer must receive part of his initial training in the workshops in order to understand the machines and people for whom he will later be designing articles.

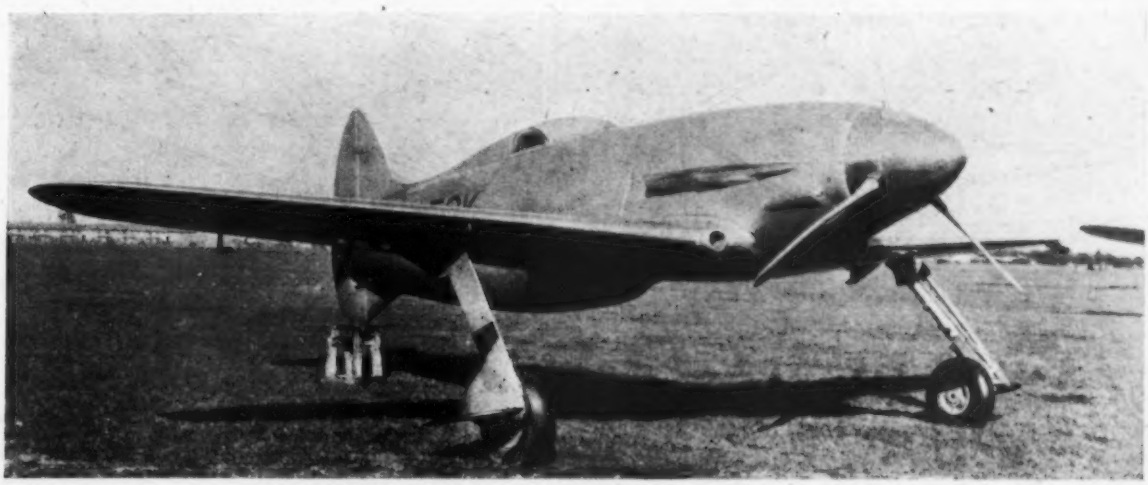
The clean lines of the racer are well brought out in this view. The Perspex windscreen was not actually fitted on the test flight.

A Co-operative Challenger

Details of a British Speed-record Design : The Nuffield-Napier-Heston Racer, Estimated to do 480 m.p.h.

MUCH ingenuity was brought to bear on a British design which, but for the outbreak of war and an unfortunate flying accident, might well have made history. The machine was intended for an attempt on the world's landplane speed record which stood officially to the credit of Germany with 610.95 km./h. (379.6 m.p.h.). That record was established by Hermann Wurster on a Messerschmitt BF 113R monoplane with Daimler-Benz engine on November 11th, 1937. Early the following year two German pilots in turn raised the figure, first to 464 m.p.h. (Dieterle on a Heinkel), and then to 469 m.p.h. (Wendel on a Messerschmitt BF 109R).

At that time the Napier Sabre engine had been fairly well developed, although it was, of course, not yet in quantity production. It promised to be the most powerful British aircraft engine, and it was natural that the Napier firm should wish to test it out in the most searching conditions. Probably it would have been impossible to find a quicker way of discovering any minor snags there might be in the new engine, and as the firm had no aircraft



A Dowty "levered suspension" undercarriage was fitted. Note the wide track and pronounced forward rake of the struts.

A CO-OPERATIVE CHALLENGER

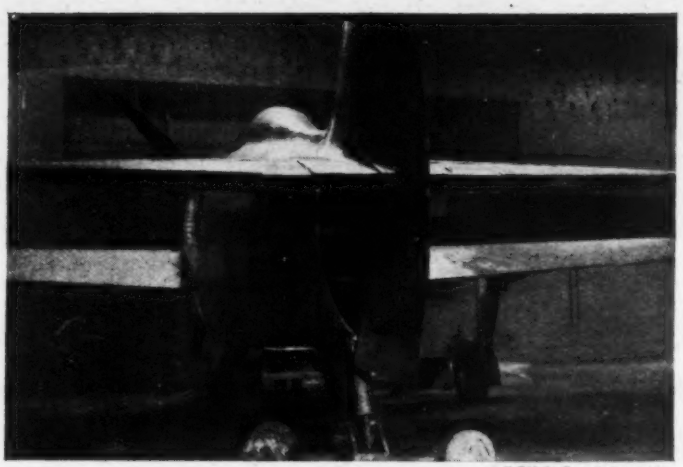
department of its own, an order was placed with the Heston Aircraft Co., Ltd., for two machines. Lord Nuffield very generously agreed to defray the cost, and Mr. A. E. Hagg, who was at the time with Napiers, laid down the general outline of the design and supervised the detail design, which was undertaken by the staff of Heston Aircraft under Mr. George Cornwall.

Around the Sabre engine Messrs. Hagg and Cornwall designed the smallest practical aircraft. It was agreed that there were to be no "freakish" features which could not be used in normal aircraft, and except for the cooling system, which *was* unorthodox, the racer was a quite straightforward machine so far as general arrangement and outline were concerned. In detail, however, there were many ingenious features.

Quick Work

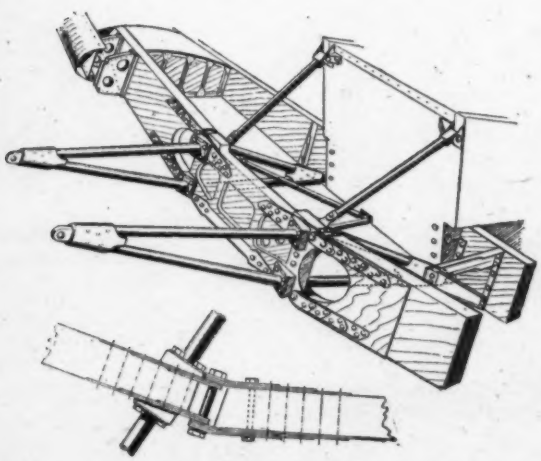
Design work began in December, 1938, and shortly afterwards the manufacture of "bits and pieces" was started. In order to have a second string in case of accident, all the parts for two complete airframes were made. By the time war broke out in September, 1939, one machine was approaching completion, while the second was something like 60 per cent. finished. The war put an end to work on the second machine, but the first was completed and the engine run on December 6th, 1939, a year after the start of the design work. Considering that the Heston company was at that time a fairly small one, this must be said to be very creditable.

Following completion, the machine had to be put through wing and airscrew vibration tests, and it was not until March 12th, 1940, that taxying trials could be carried out. On these it was found that the new machine showed no vices such as excessive swinging or tendency

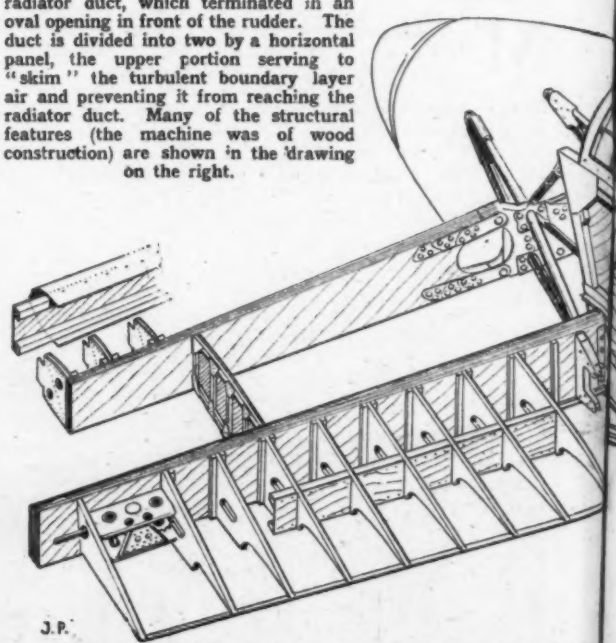


"*Flight*" photograph.

The deep belly of the fuselage housed the radiator duct, which terminated in an oval opening in front of the rudder. The duct is divided into two by a horizontal panel, the upper portion serving to "skim" the turbulent boundary layer air and preventing it from reaching the radiator duct. Many of the structural features (the machine was of wood construction) are shown in the drawing on the right.



No illustration of the Napier Sabre engine may be published, but these are the bearers for it.



J.P.

This sketch by a *Flight* artist was made before the Nuffield-Napier-Heston racer was finished, which accounts for the fact that certain details are omitted, notably control leads and surfaces. The latter were of metal construction, fabric covered. It will be observed that the engine was above the front spar.

to ground loop, and the torque reaction was, surprisingly enough, far smaller than had been expected, so that the very wide wheel track appeared rather unnecessary.

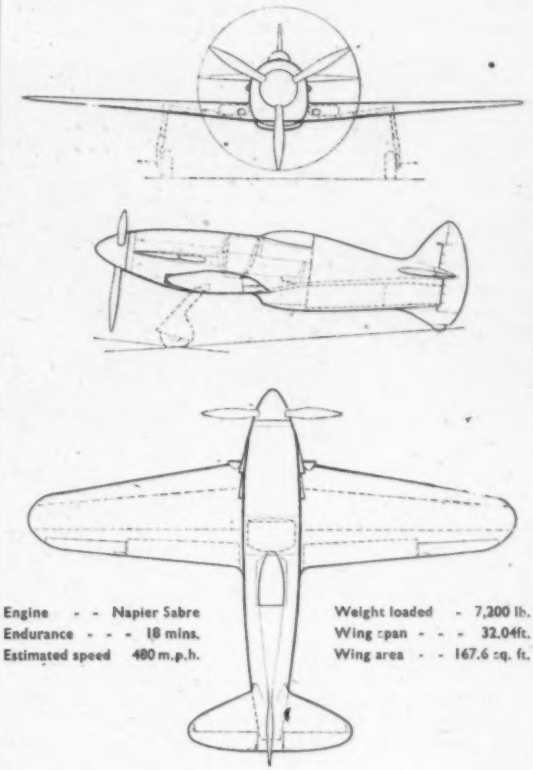
While waiting for suitable weather conditions (remember, the machine was loaded to about 43 lb./sq. ft., which was startling in those days) time slipped by, and it was not until June 12th, 1940, that Heston's chief test pilot, Sqn. Ldr. G. L. G. Richmond, decided to make the first proper flight. The machine took off normally, but after a flight of about seven minutes the engine overheated, owing to unforeseen cooling trouble, and the pilot was obliged to approach and attempt a landing without the use of engine. Unfortunately, the aircraft levelled out at a height of about 30ft. and, it being impracticable to use the uncooled engine for another circuit, the machine was stalled. The stall was gentle, and there was no wing-drop until well below the stalling speed, but the pilot was unable to save the aircraft, which was wrecked.

Clever Simplicity

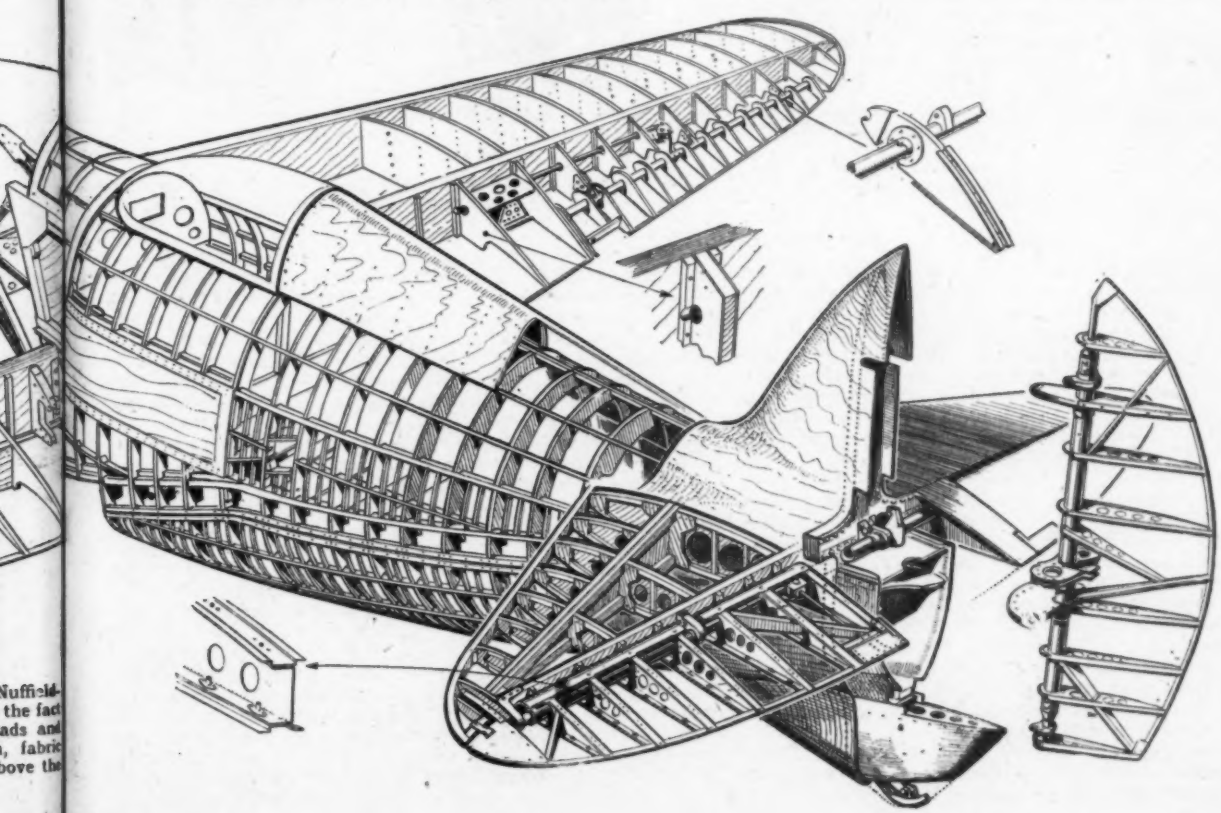
Fundamentally the racer was, as already mentioned, of orthodox design: a low-wing monoplane with everything kept as clean as possible. Thus there were no projecting control levers or mass balances, and the surfaces of wings and fuselage were very highly polished. For example, at critical points, such as the leading-edge of the wing, the surface was polished and treated until no scratches were present of a greater depth than 0.0005in.

Wooden construction was chosen partly because it was quicker when building two machines only, and partly because it lent itself to the production of very smooth surfaces without "waves."

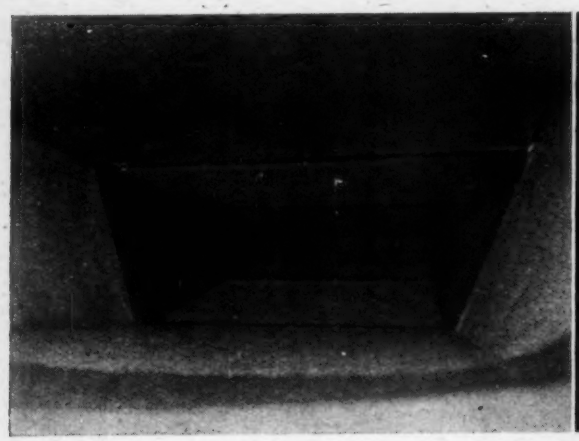
Of approximately straight taper plan form, the wings had sections of the bi-convex type, symmetrical over the greater part of the span, but slightly cambered near the tips so as to improve the tip-stalling characteristics. The maximum ordinate was located unusually far back (at 40 per cent. of the wing chord) so as to delay the onset of the shock-stall up to higher speeds than were expected.

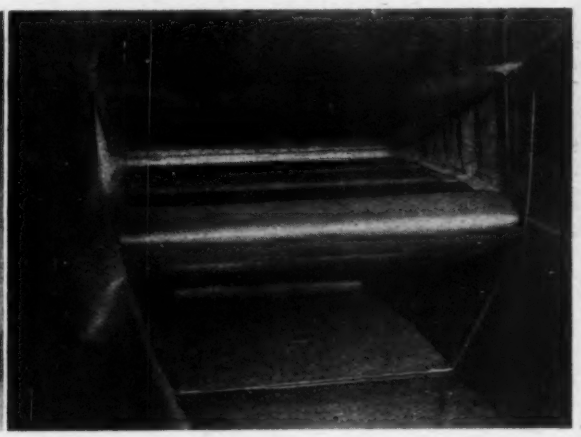


Engine	Napier Sabre	Weight loaded	7,200 lb.
Endurance	18 mins.	Wing span	32.04ft.
Estimated speed	480 m.p.h.	Wing area	167.6 sq. ft.

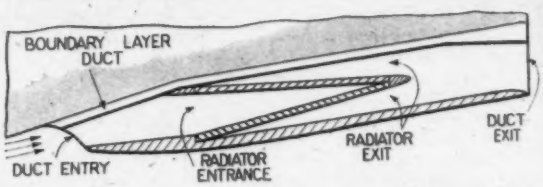


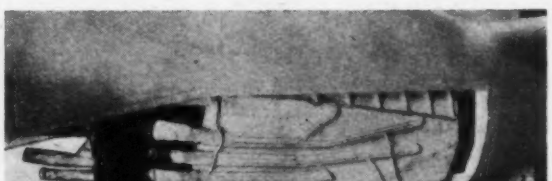
A CO-OPERATIVE CHALLENGER





Cooling air entered the duct at the forward end, was expanded and slowed down in the duct, and allowed to escape at the stern. *"Flight" photographs.*





The principle of the ducted Gallay radiator is shown in the diagram, and the photograph shows the feed pipes on the outside of the duct.

At the wing roots the ratio of wing thickness to wing chord was 16.2 per cent. and at the undercarriage attachments it was 12.8 per cent. The thickness at the tips was 9 per cent. The wing as a whole was, aerodynamically, untwisted. The camber at the tips appears to have delayed tip stalling satisfactorily, for when the machine stalled and crashed it did not hurriedly "drop a wing."

The basis of the fuselage outline was a good streamline shape of low drag, and in order to spoil it as little as possible the windscreen was as low as was considered compatible with sufficient view, while the cooling system was, as previously mentioned, of a novel type in order to avoid the unsightly and drag-producing "whiskers" of an underslung radiator. Put briefly it was ducted cooling, with a special Gallay radiator housed in a tunnel in the bottom rear portion of the fuselage.

All control surfaces were carefully mass-balanced and provided with mass balanced trimming tabs. It was thought that the ailerons in particular would need careful setting of the tabs, but the torque reaction was found to be damped out by the wings.

"Compregnated" Wood

So far as the structure is concerned, it is interesting to record that extensive use was made of Saro compressed and impregnated timber and plywood mouldings. In some places the timber was compressed to 62.5 lb./cu. ft. The main wing spars were of box type, the rear spar straight but the front spar having a backward rake which necessitated metal fittings at the sides of the fuselage. The wing covering was fairly thick birch ply which, combined with closely spaced ribs, ensured freedom from waves and wrinkles. The leading-edge was a pre-formed plywood moulding.

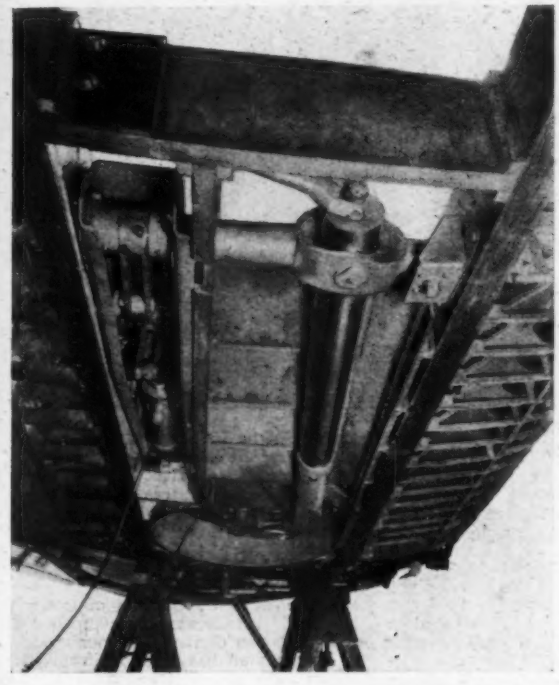
The fuselage was of birch plywood with spruce frames and stringers. The lower part formed the radiator duct and was divided by a horizontal panel into two compartments, the upper being intended for "skimming" the turbulent boundary layer and keeping it away from the radiator duct. The speed of the cooling air was gradually reduced by increasing the duct area, so that by the time the air reached the radiator it was travelling at quite low speed, something like one-third of the flight speed. It was led into the narrowing angle between the two Gallay radiator portions, which were arranged in the form of a vee, and were of such large surface area that the flow through the radiator was reduced to about 30 m.p.h. The air then passed out through the open stern of the fuselage.

Very special care was taken in connection with the control surfaces. For instance, it was realised that at the speeds contemplated delicacy of control would be essential, and a very neat and simple variable-speed device was incorporated which gave very small movement of control surfaces near the neutral position for a fairly large movement of the control stick or rudder pedals, but the gearing increased rapidly as the angle of maximum control angle was approached.

Avoidance of backlash in control surface tabs is always a serious problem in high-speed aircraft. In the racer this was achieved in a very simple manner: a torque rod had its free end bent over at an angle of about 30 deg. and the free end engaged, without "play," in a slot in the tab. Control surfaces, by the way, were of metal construction with fabric covering. Ailerons were of the Frise type, with the hinge line almost on the upper wing surface. The gap between aileron and wing was completely sealed on the upper surface. Mollart universal joints were used where angles in the landing flap spars had to be negotiated.

Dowty hydraulic control was used for the wing flaps and undercarriage. The Dunlop wheels were mounted on fittings of the Dowty "levered suspension" type, and it will be noticed that the struts were raked forward at a rather unusual angle. This was due to the fact that they were pivoted to a stout universal member housed between the front and rear spars, i.e., farther aft than usual.

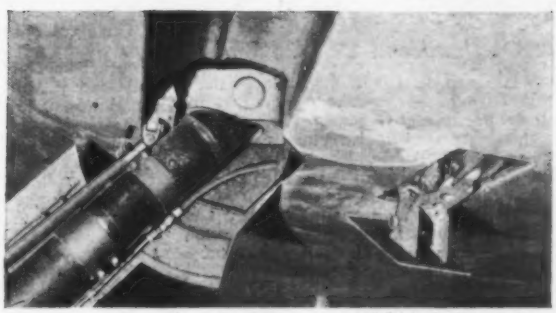
A CO-OPERATIVE CHALLENGER



The starboard undercarriage leg. A universal joint between the spars gave the undercarriage struts freedom to pivot for retraction. The jack is seen on the left.

Of the Napier Sabre engine little may be said, since its details are still regarded as secret. It is, however, known that it is the engine of the Hawker Typhoon fighter, and not without interest to point out that the engine in the Nuffield-Napier-Heston racer was the first. Fuel for 18 minutes at full power was carried in an Electron tank just forward of the cockpit instrument panel. The airscrew of the first machine was a De Havilland constant-speed three-blader. The second machine was to have had a De Havilland Hydromatic. The engine cowling was sealed against air leaks, even around the ejector exhaust stubs, but to reduce risk of fire or explosion, small temporary ventilation holes were made in the cowling.

The Nuffield-Napier-Heston racer was a truly co-operative affair. All components, etc., which were sub-contracted, were supplied free by the makers, who thus very helpfully came forward to support this very sporting venture. It was a great pity that the outbreak of war prevented the second machine from being completed. A great deal of useful information might then have been collected which would have been of direct assistance in the war effort.



"Flight" photographs.

Undercarriage details. At the top a complete unit, and above the fitting at the upper end of a leg. The plate on the right covered the crank when the undercarriage was retracted.

Following are the main available data of the Nuffield-Napier-Heston Racer:—

Weight fully loaded	7,200 lb.
Wing Span	32.04 ft.
Length, o.a.	24.6 ft.
Wing area	167.6 sq. ft.
Wing loading	43 lb./sq. ft.
Fuel capacity	73 gals.
Oil capacity	15½ gals.
Endurance at full power	18 mins.
Estimated level speed	480 m.p.h.

AIRCRAFT RECOGNITION SOCIETY

THE inaugural meeting of the Aircraft Recognition Society was held on April 1st at Unilever House, Blackfriars.

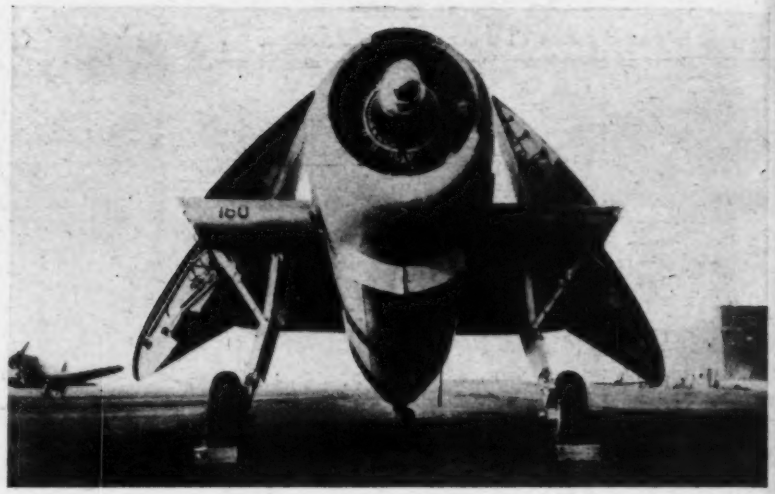
This new society has been formed to cater for those whose interest in that vitally important subject has led them into one or other of the Services, civil or military, whose business it is to recognise aircraft. The aim is to promote interest in all branches of aircraft recognition, and by lectures, meetings and competitions to raise the standard to the highest possible level. Now that official training schemes are in full swing throughout the Services, it is hoped that the new society will bring together enthusiasts from all these Services on a common ground to their mutual advantage. Meetings will be held at Unilever House on the first Thursday of each month.

CANADIAN MAIL

AS a result of numerous enquiries received from relatives and friends of R.A.F. personnel serving or training in Canada, it was announced recently that a large consignment of mail from Canada has been received in this country for immediate distribution.

"Canadian service personnel in this country have been in exactly the same position as relatives and friends of R.A.F. personnel stationed in Canada in regard to mail," an R.C.A.F. officer explained. "We have received numerous enquiries in regard to mail from R.A.F. personnel in Canada, and there seemed to be an impression that consignments for Canadian Service personnel were receiving priority treatment. This, of course, is far from the fact.

HERE AND THERE



FLYING FISH : The Grumman Avenger, known in the U.S. Navy as the TFB-1, has been given the name Tarpon in the Fleet Air Arm. It can take a 21in. torpedo enclosed in the bay beneath its belly, has a gross weight of 12,000lb., a cruising range of 1,400 miles and a top speed of about 270 m.p.h. Observe that the wings fold back in British fashion instead of upwards in the usual American way, and that the engine is being run-up with the wings folded, which is also rather unusual.

New Zealand Airmen

THE fact that to-day there are 10,000 New Zealand airmen serving overseas and 20,000 men in training has been revealed by Mr. Frederick Jones, New Zealand Defence Minister, on arrival in England to visit his fellow-countrymen.

In 1936 only 110 men were serving in the R.N.Z.A.F.

Another U.S. Aircraft Carrier

A NEW type of United States aircraft carrier, the Breton class, is now ready for service with the fleet, having successfully completed her trial runs.

The Breton, which is described as a highly manœuvrable ship, was built in record time.

Overburdened U.S. Air Mail

AIR mail in the United States may have to be restricted, according to the Postmaster-General, Mr. Frank Walker. Aircraft carrying mail have been greatly overburdened, and it may become necessary to ban the general public from using air mail.

Overseas air mail to this country has not yet been rationed, but for some time now letters bearing air mail stamps have been going by boat.

Air Transport Facts

A SERIES of memoranda setting forth the saliant aspects of air transport is being issued by the Joint Air Transport Committee of the Association of British Chambers of Commerce, the Federation of British Industries and the London Chamber of Commerce.

The first of these analysed the "freedom of the air" as consisting of three freedoms, namely, air passage, air facilities and air trade; the second memoranda now circulated deals with the first of these three "freedoms," in the course of which it mentions the suggestion that below a certain height, say, 10,000ft., the air should be territorial and thus owned by the State, but free above that altitude.

Thinking Big

HENRY J. KAISER, who certainly worked wonders in shipbuilding without knowing very much, if anything, about ships, is now reported in *The Times* to be planning a new "monster of the skies" which may be used both as a transport aircraft and for bombing Japan.

The newspaper's New York correspondent says the projected aircraft is of the flying-wing type with a span of no less than 282ft. and is to be powered by four 2,000 h.p. engines. Its useful load is said to be 45 tons; its gross weight 87½ tons.

The most staggering figure quoted is a maximum range of 17,000 miles "with no other load than fuel," but even with full load it will be capable of "many thousands of miles non-stop."

Kaiser is quoted as saying he intends to build this monster at once.

Whether this latest ambition is in addition to, or in substitution of, the seven-engined sky-giant he was talking about a short while ago is not indicated.

R.Ae.C. Recommendations

A BRIEF outline of recommendations on post-war civil aviation, drawn up by a special committee of the Royal Aero Club was given by the chairman, Lt. Col. Sir Francis McClean, at the club's annual general meeting recently.

These recommendations, which had been sent to the Secretary of State for Air, stressed the need to revive flying and gliding clubs throughout the country, the provision of facilities for flights abroad, and the encouragement of private owners and sporting events.

Run Willow Run!

ACCORDING to Mr. Charles Wilson, vice-chairman of the U.S. War Production Board, the Ford factory at Willow Run will be turning out 500 bombers a month "by the time the next snow flies."

Mr. Charles Sorensen, vice-president of the Ford Motor Company, is reported to have said that if the production figures could be revealed they would "scare Hitler to death."

So far, however, they have only agitated Senator Truman, who recently described them as almost negligible!

Strength Through Reorganisation

THE United States Army Air Force high command has been reorganised to make it the strongest possible striking force. The force is expected to exceed 2,000,000 men by the end of this year and this great increase has compelled the reorganisation of the high command.

The air staff has been cut from 19 to six major sections. General Arnold and Maj.-Gen. Stratenmeyer, however, retain their posts.

Women for Aircraft Repair

WOMEN are playing a very important part in the diagnosing and repair of damaged aircraft. Mr. R. H. Dobson, managing director of A. V. Roe and Co., Ltd., has stated that of the technical and skilled labour required to repair Lancasters and other bombers that have been damaged during raids over enemy territory more than 50 per cent. is provided by women.

New Appointment at General Aircraft, Ltd.

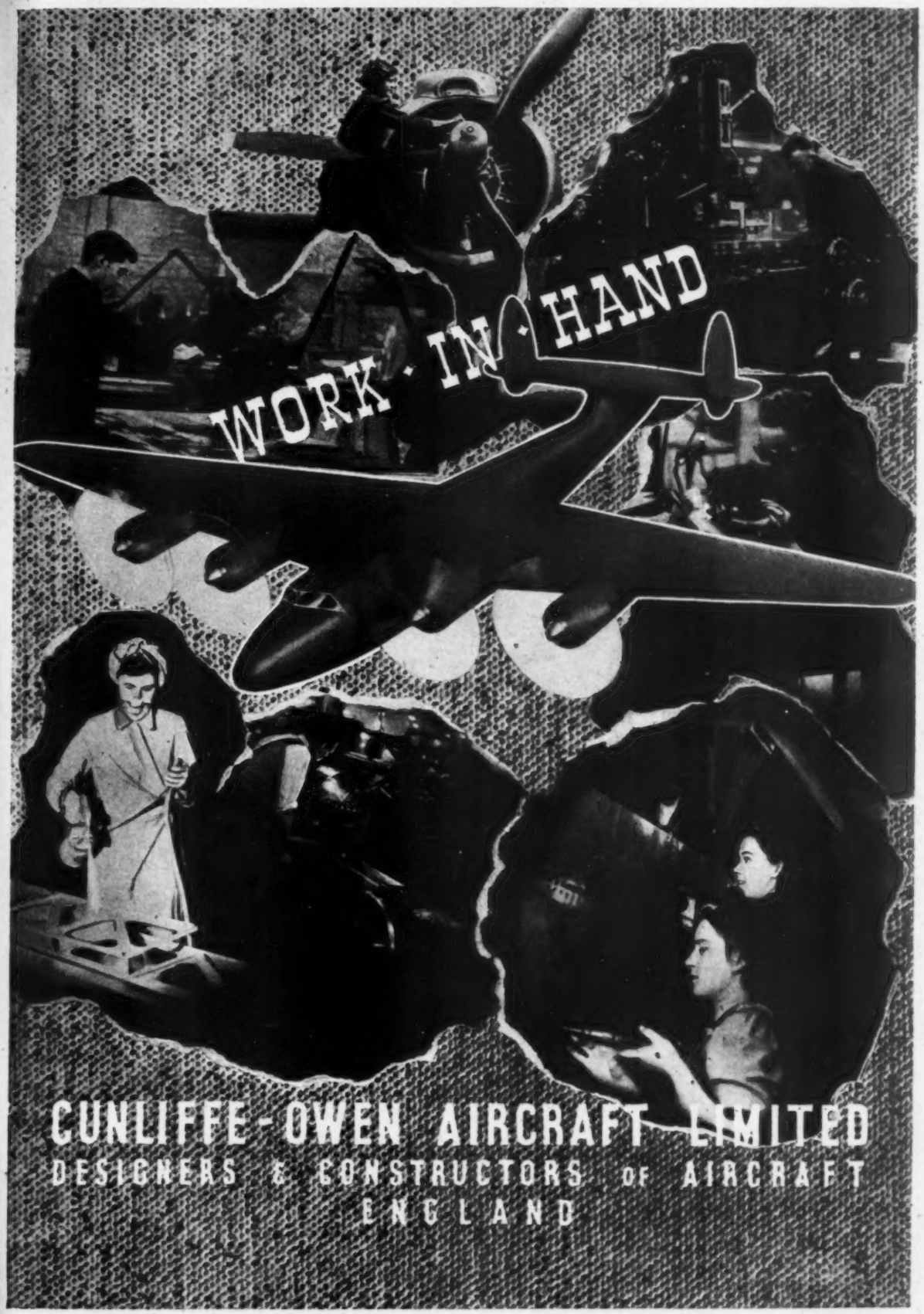
THE appointment is announced of Mr. H. M. Barton, chartered accountant, to controller of General Aircraft, Ltd., in succession to Mr. K. A. Layton-Bennett, who has relinquished the post owing to ill-health.

Mr. Layton-Bennett had been appointed controller of both Short Bros. and General Aircraft, Ltd., but the formation of a new Board at Short Bros. made that period of office of brief duration.

Scientist's Appointment

MR. A. PARKER, D.Sc., F.I.C., M.I.Chem.E., who has been Acting Director of Water Pollution Research since the outbreak of war, and has served for many years on the council of the Institution of Chemical Engineers, has now been appointed Director of Fuel Research in the Department of Scientific and Industrial Research.

Mr. Parker joined the staff of the department in 1928 and had previously been engaged on research for the gas industry.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Aircraft Types and

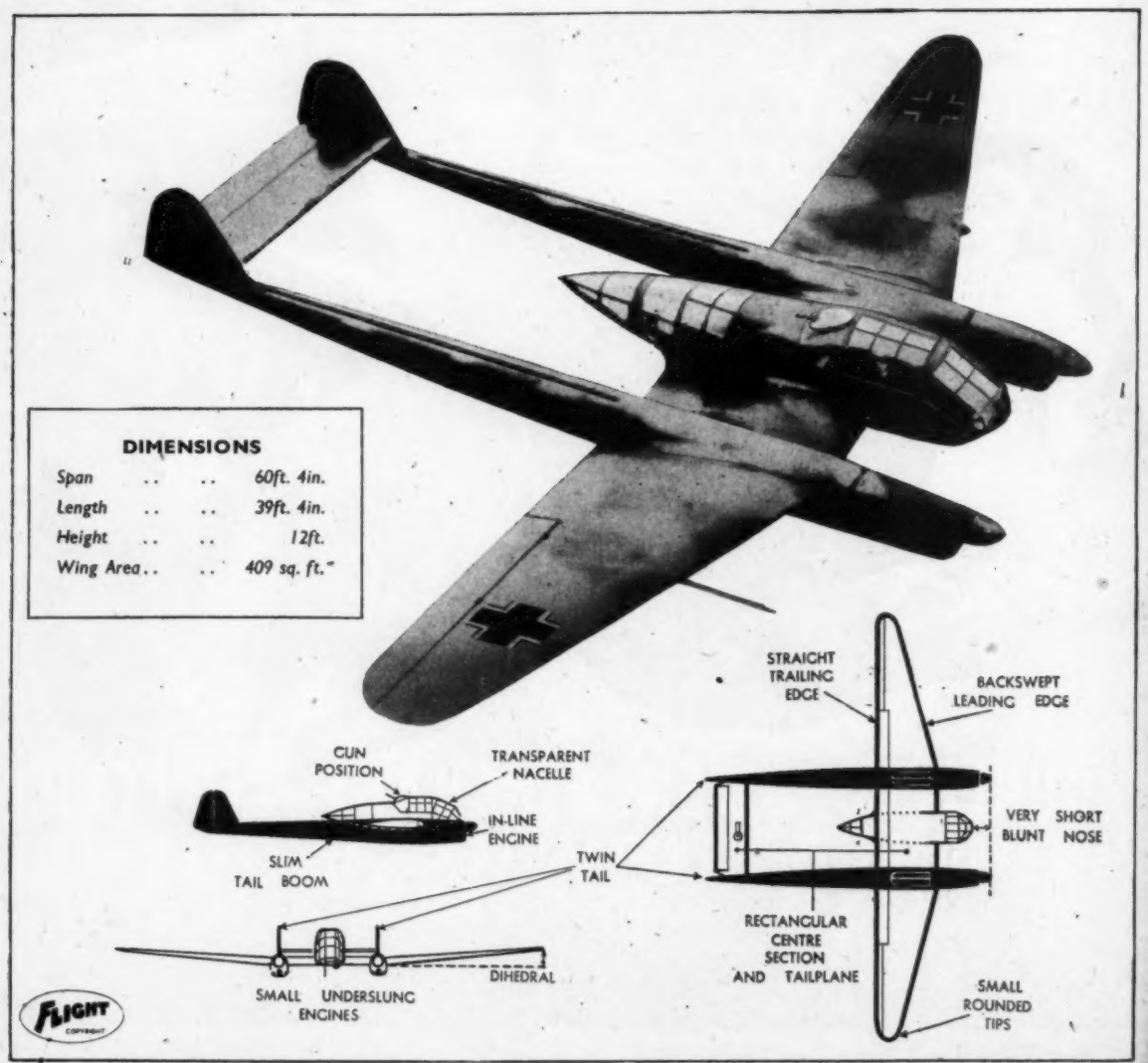
FOCKE-WULF Fw189

DESCRIBED as suitable either for army co-operation or for advanced training, the Fw 189 was reported to be under development during the early months of the war; its type number was not then known, but it was known that the Focke-Wulf concern was working on a new monoplane with twin tail-booms. In the spring of 1941 the first production Fw 189s went into service either to replace or supplement the Henschel Hs 126 for army co-operation work and, more recently, they have been encountered in action on the Russian front.

Powered by a pair of 12-cylinder, inverted "V" air-cooled Argus As 410 engines, each providing 370 h.p. at 9,840ft. and 450 h.p. for take-off, the Fw 189 has a top speed of 222 m.p.h. at 8,530ft. and a service ceiling of 27,550ft. It has a very light wing-loading (as modern wing-loadings go) at 18.28 lb./sq. ft., its total loaded weight being only 7,480 lb.

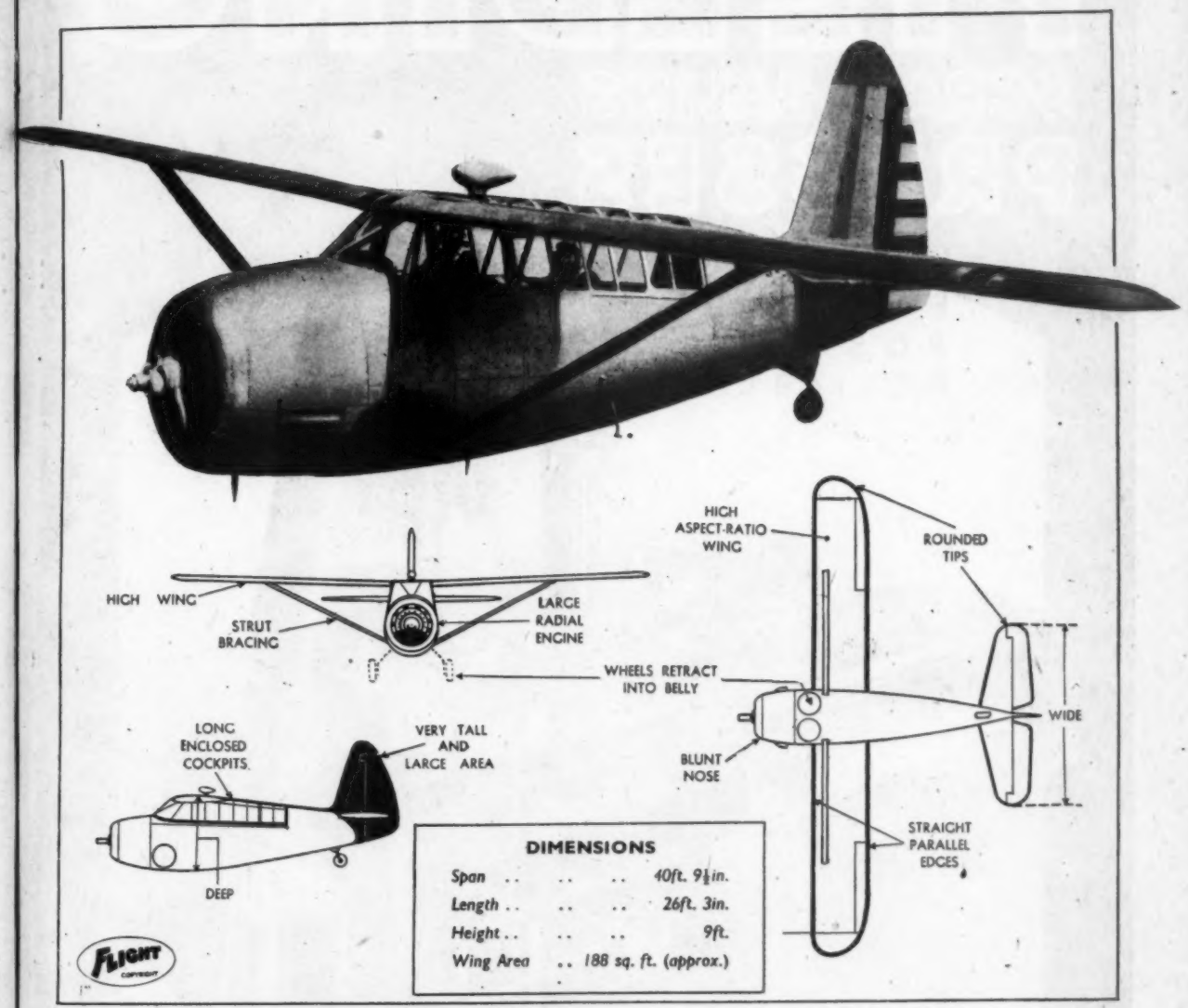
Armament consists of four machine guns disposed as follows: there are two fixed forward firing guns in the lower part of the nose which are operated by the pilot, one movable gun in the cupola mounting above the nacelle, and another movable gun in the conical mounting at the rear end of the nacelle. Additionally, light bombs may be carried for ground attack.

As will be seen in the illustrations below, the Fw 189 employs the twin tail-boom construction, and there is thus a possibility of confusing it with the Lockheed Lightning, but appreciation of certain clearly discernible differences will obviate this danger. The wing plan of the Fw 189, for example, has a rectangular centre-section, while the outer panels have a straight trailing-edge and sharply backswept leading-edges outboard of the engines; the Lightning, however, has a uniform taper on both edges right from the centre nacelle. On the German machine, the nacelle projects almost equally in front and behind the centre-section of the wing, whereas on the Lightning it projects well ahead of the spinners but ends flush with the trailing-edge. Moreover, the Fw's nacelle has an exceptional degree of transparency both fore and aft, and is altogether fatter than the Lightning's slim single-seater nacelle. The absence of radiators on the flanks of the tail-booms will also be noted on the Focke-Wulf.



heir Characteristics

CURTISS OWL



DIMENSIONS

Span	*40ft. 9½in.*
Length	*26ft. 3in.*
Height	*9ft.*
Wing Area ..	*188 sq. ft. (approx.)*

ONE of the latest types of American Army observation aircraft, the Curtiss Owl (O-52 in the U.S. Army Air Force), presents a somewhat curious appearance to British eyes if only because high-wing, strut-braced monoplanes with retractable undercarriages are a rarity—the famous Heston Phœnix of pre-war vintage was a solitary example of the type in this country. Actually, the Owl employs the characteristically American radial-engined fuselage, and the wheels retract into the belly, and it rather gives the impression that it was originally meant to be a conventional-looking low-wing monoplane but had been modified into a high-wing type. This is merely because we are not accustomed to associating strut-braced high wings with this type of fuselage.

The result, however, has been to produce an aircraft which provides its crew with particularly good visual range plus a satisfying performance. The Owl is, therefore, well suited for surveying, mapping work and photography, as well as for its primary functions of scouting and general liaison with ground troops.

Powered by a Pratt and Whitney Wasp nine-cylinder air-cooled radial engine, the Owl's fuselage is an all-metal, oval monocoque structure with light alloy flush-riveted, stressed-skin covering. Its wings, which are of high aspect-ratio and have straight parallel edges, are also an all-metal structure but with fabric covering aft of the metal-covered leading-edge. The tail plane, fin and rudder are all-metal except for the movable surfaces, which are fabric-covered. The tailplane, it will be noticed, is of unusually wide span and of much higher aspect-ratio than is usual in American designs of this type; the fin and rudder are of large area and quite exceptionally tall.

Slots occupy the entire length of the leading edge of the wings, and plain hinged flaps are fitted.

The long, transparent cover to the cockpits, which reaches more than halfway back to the fin, would suggest that a crew of three was carried; but, in point of fact, the Army specification to which this machine was designed only called for a two-seater. This is, in itself, an interesting detail, since it is a return to earlier practice; the specification of its predecessor, the North American O-47B, required accommodation for a crew of three.

FIELDING

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Air Transports

Some Speculations on Future Designs for Civil and Military Purposes : The Importance of Loading and Stowage Facilities

By C. A. H. POLLITT and J. H. LAVER

A GOOD deal is heard these days about the importance of air transport in regard to post-war planning, and soon we should have a definite Government plan for developing our previously meagre air services.

If we are to assume that the time has come to consider development of civil aviation in all its aspects we must have on hand a formulated programme taking into account all the demands that are likely to be made upon our air services. Such a programme must embrace the question of equipment, and it is the purpose of these notes to touch upon the more obvious features of air transport design as they are affected by operational requirements.

Geographically we are admirably placed for serving by air either Western Europe or the Americas, and we can employ at our discretion either landplanes or flying boats, or both. For long sea crossings the flying boat is the ideal in so far as the transport of passengers is concerned and is likely to remain so. Within the scope of these notes, however, it is proposed to confine attention to some possible civil and military landplane transports.

There is a constant evolution, not only in the requirements of civil transport operators, but also in those of the Army, and present military equipment renders obsolete practically all our better-known transport types. The general proportions of certain of these items of equipment inevitably prescribe very definite limitations on general layout, and the mid-wing formula is ruled out on the score of valuable fuselage space being sacrificed to accommodate the wing centre section. Only in the very much larger types where two or more decks are possible is it likely that the mid-wing type will gain any prominence.

To facilitate the loading of small tanks or pieces of light artillery it is desirable that the fuselage of the aircraft shall be disposed as near the ground as practicable, and it will assist materially if the aircraft is in a tail-up attitude during the operation. Both these conditions are satisfied by resorting to a high-wing layout with tricycle undercarriage.

Furthermore, use of a high-wing arrangement makes possible an overhead control system thereby eliminating a number of pulleys and brackets and giving easy access for servicing through the fuselage roof. Servicing is a moot point and much remains to be done in regard to making ample provision in the early design stages for ease of access.

Engine manufacturers are taking appropriate steps to cope with the problem, and present indications are that they will be well abreast of similar developments on the aircraft side. Power plant design has made remarkable progress during the past five years, and development has embraced every phase of maintenance in the field. Portable scaffolding was never a satisfactory answer, and something more self-contained can only be regarded as the logical outcome.

SOME very unorthodox designs are proposed by the authors of this article, and there will be general agreement with their statement that "It has to be conceded that extensive wind-tunnel tests would perforce need to be carried out before such a project could be embarked upon."

The rudders in the tail-first design (Fig. 4) would have to act as "drag rudders," and the size of the tilted wing tips in Fig. 7 appears inadequate.

Reverting to loading requirements: There is an essential need to load mechanised military equipment from the rear and to incorporate a loading ramp as an integral part of the fuselage structure, in much the same manner as with beach landing craft. This is advantageous in that it makes rapid unloading and eliminates carrying the ramp as separate auxiliary equipment.

Design for Stowage

Loading and stowage are complementary to one another and have a greater influence on transport fuselage design than any other factor. This is especially true of the type we are considering here, and to perceive the cogency of these arguments it might be profitable to examine them in the light of present-day practice as exemplified by a current type.

The foremost cargo transport of to-day is perhaps the Curtiss C.46, the Commando, a military adaptation of an earlier twin-engined air liner with a remarkably roomy interior. Judged by present-day standards this is a fine aircraft, distinguished by its ability to carry several Jeeps in addition to a number of fully armed troops. The pity of it is, that loading is through a side entrance which involves what must be, to put it mildly, a difficult right-angle turn. But for this inevitable restriction something much larger than a Jeep could have been got within that fuselage, for there is room and plenty, once inside.

The machine itself stands high off the ground, with the loading ramp at a correspondingly steep angle calling for careful, and therefore slow, handling of vehicles.

Briefly, the crux of the matter is that an aircraft specifically designed as a civil airliner cannot be expected to meet the exacting requirements of a military transport as efficiently as a machine designed for the purpose.

There is not the slightest doubt that services to and from the Western European capitals will figure prominently in the general scheme of things, and there are two distinct schools of thought as regards the most economical method

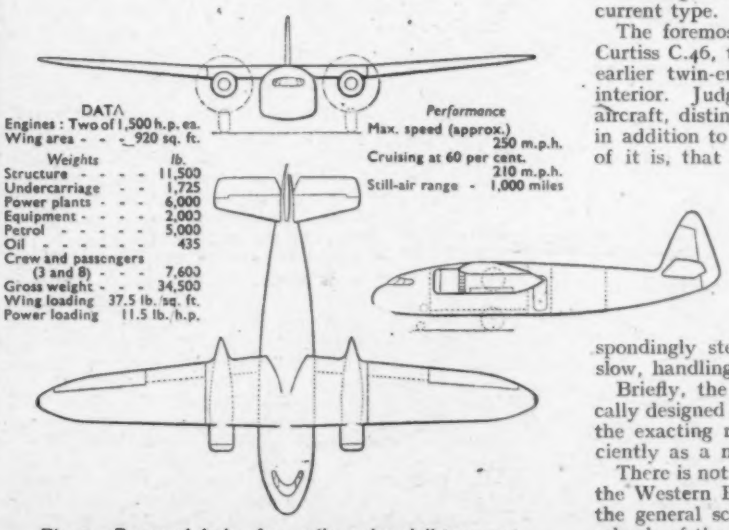
DATA
Engines : Two of 1,500 h.p. ea.
Wing area - - - 920 sq. ft.
Weights lb.
Structure - - - - 11,500
Undercarriage - - 1,725
Power plants - - - 6,000
Equipment - - - - 2,000
Petrol - - - - - 5,000
Oil - - - - - - 435
Crew and passengers (3 and 8) - - - 7,600
Gross weight - - - 34,500
Wing loading 37.5 lb. sq. ft.
Power loading 11.5 lb. h.p.
Performance
Max. speed (approx.) 250 m.p.h.
Cruising at 60 per cent. 210 m.p.h.
Still-air range - 1,000 miles

Fig. 1. Proposed design for medium-size civil transport.

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of operating those services. One advocates the use of small fast types operating a frequent service, as opposed to larger and possibly, though not necessarily, slower types working an infrequent service.

If we subscribe to the belief that a fast, medium-sized twin-engined type maintaining a moderately frequent service is an attractive compromise, we may well go further and endeavour to visualise such a type. That shown in Fig. 1 comes within a category which would meet the requirements adequately and efficiently. It is a conventional and practicable layout reflecting a modern tendency in general design, and featuring modest internal appointments.

Passenger comfort is of paramount importance, and the degree of luxury should be consistent with the travelling time. There is absolutely no need to overdo the business, as has been the wont of some American airline concerns. The fundamental requirements are: roomy comfortable chairs; good ventilation; cabin heating; sound-proofing to the level of, say, 60 decibels; and the usual toilet accommodation.

The modern idea, however, favours the four-engined type for ranges of this order, though this is something of a basic fallacy since two modern power plants can comfortably maintain the required power output for services of this sort. Furthermore, a forced landing would see a four-engined machine more seriously handicapped than its twin-engined counterpart, particularly where small fields are concerned.

Bomber Adaption

It is unlikely, however, that the immediate post-war years will produce anything resembling the design in question. More probably we shall see the wings, undercarriage, and empennage of an existing type adopted to an entirely new fuselage. This would greatly facilitate production and appreciably reduce the otherwise considerable time lag inevitably associated with the development of any new aircraft.

After the war, the transport by air of really heavy merchandise will be one of the added facilities of our improved communications. Here, perhaps, more than ever before, will it be necessary to subordinate aerodynamic efficiency to practical requirements, and the corollary is that speed will be sacrificed to load-carrying capacity.

Simply and briefly, there is a broad distinction between present-day fuselage design and that which future needs

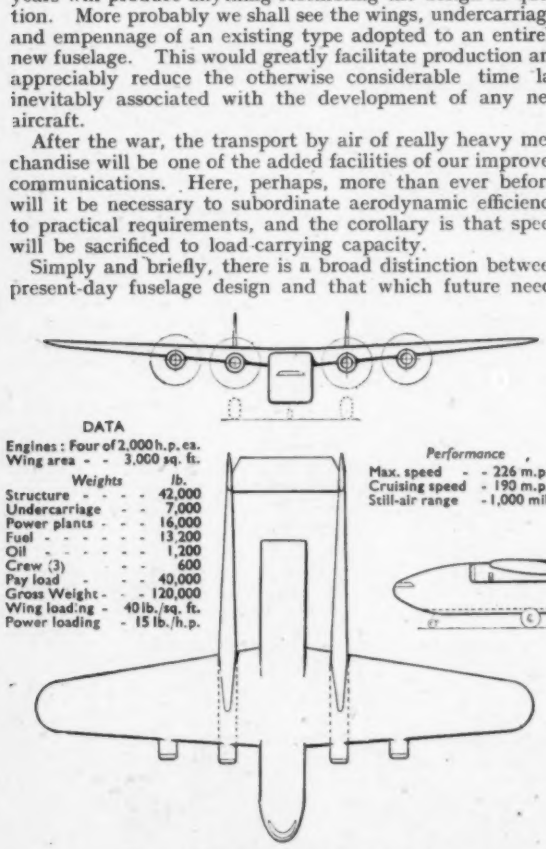

DATA
Engines: Four of 2,000 h.p. ea.
Wing area - - 3,000 sq. ft.
Weights lb.
Structure - - - - 42,000
Undercarriage - - 7,000
Power plants - - 16,000
Fuel - - - - - 13,200
Oil - - - - - 1,200
Crew (3) - - 600
Pay load - - 40,000
Gross Weight - - 120,000
Wing loading - 40 lb./sq. ft.
Power loading - 15 lb./h.p.
Performance
Max. speed - - 226 m.p.h.
Cruising speed - 190 m.p.h.
Still-air range - 1,000 miles

Fig. 2. Heavy freight transport type.

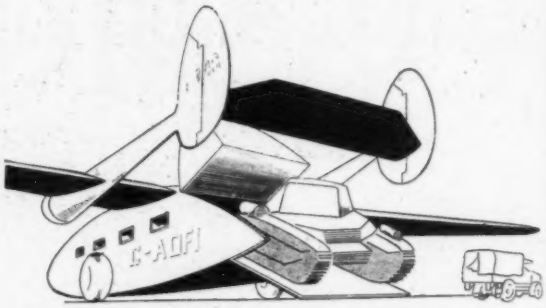


Fig. 3. Rear-loading arrangement of machine shown in Fig. 2.

will demand. If, for a moment we pause to realise that something like one-third the length, that at the rear extremity of a modern fuselage, cannot be used for load-carrying purpose, we have an obvious example of the need for modified design.

The metamorphosis would be influenced mainly by the general bulk of whatever commodities were to be carried, but it would follow that unless an aircraft were permanently engaged in carrying the particular form of cargo for which it was expressly intended it would occasionally fall short of its maximum operational efficiency. On the other hand, the final overall dimensions had been settled, a fuselage could be deprived of internal obstructions to such an extent as to render it capable of accommodating well-nigh anything whose rectangular proportions were slightly less than its own. In other words, weight must be assessed in terms of bulk.

A Freight Transport

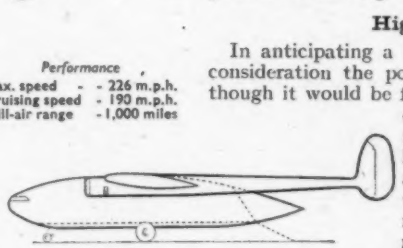
In Fig. 2 a design is laid down for a heavy freight transport equally suited by virtue of its commodious interior to the carriage of moderately heavy military equipment or general merchandise. To strike a topical note, its function has been defined primarily as that of a tank transport, a type now conspicuous by its absence, in this country at least. Loading is from the rear and a ramp is incorporated.

Aerodynamically, it leaves a lot to be desired, but this is the avowed intention. What does matter is that most of the load is concentrated about the c.g. with a minimum waste of space at the rear and only the slightest of gradients to contend with in loading.

Tanks would drive in under their own power, and a stipulated roof clearance would facilitate entry and egress for personnel climbing on top of the vehicles.

High-altitude Mails

In anticipating a future era we will need to take into consideration the possible trend of events at that time, though it would be foolhardy to attempt an accurate prediction. One thing we may safely estimate is that the Airgraph service will have become permanently established and entered into universal use. This would mean that one ton of pre-war mail would be contained within a much smaller compass and, broadly speaking, the pay-load of our aircraft need be little more than that of the Mercury, which was about the nearest we ever got within the medium size fast mail aircraft category.



Our specification will therefore call for—

1. Cruising speed not less than 375 m.p.h. at 26,000ft.;
2. Still-air range of 3,000 miles;
3. All-up weight not to exceed 30,000 lb.;
4. Pay load to be not less than 2,000 lb.;
5. Crew of two (pilot and radio operator);
6. Standard duration at cruising speed 8.25 hours;
7. Not more than two engines to be used.

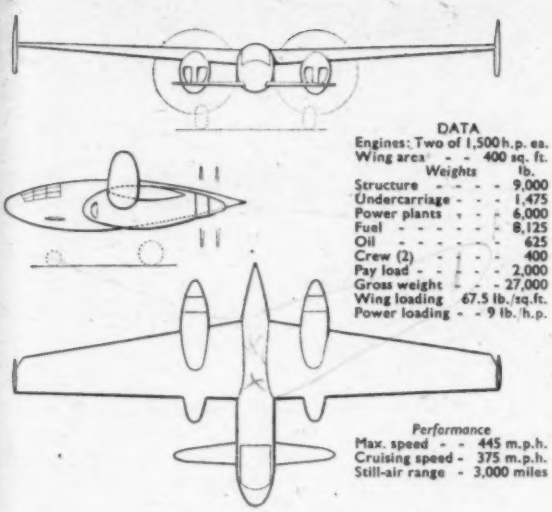

DATA
Engines: Two of 1,500 h.p. ea.
Wing area - - 400 sq. ft.
Weights lb.
Structure - - - - 9,000
Undercarriage - - - 1,475
Power plants - - - 6,000
Fuel - - - - - 8,125
Oil - - - - - - 625
Crew (2) - - - - 400
Pay load - - - - - 2,000
Gross weight - - - 27,000
Wing loading 67.5 lb./sq.ft.
Power loading - - 9 lb./h.p.
Performance
Max. speed - - 445 m.p.h.
Cruising speed - 375 m.p.h.
Still-air range - 3,000 miles

Fig. 4. Twin-engined mail aircraft.

Dealing first with the power plants. The stipulated range will enable us to consider operating at sub-stratosphere altitudes for which purpose the pusher power plant is preferable. Two of the benefits accruing from this arrangement are purely aerodynamic and ensure first, laminar airflow, and secondly, local air velocities in the subsonic range. Both these attributes are even more highly desirable at high altitudes than at sea level. The liquid-cooled in-line engine is the better installation for a pusher power plant in that it can be more easily mounted in the wing without presenting quite the same cooling difficulties, as, say, a radial air-cooled engine.

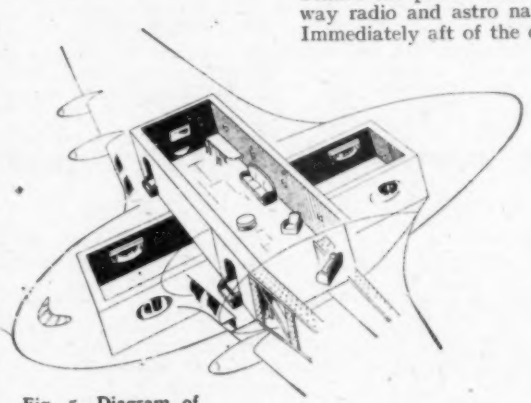


Fig. 5. Diagram of cabins of machine shown in Fig. 7.

A popular conception of the pusher installation is that embodying an engine buried within the wing. This we are precluded from using by reason of physical limitations imposed by the machine itself, which will be of comparatively moderate proportions. The nearest approach we could make would be to use a flat engine such as the Lycoming, although two liquid-cooled engines of about fifteen hundred horse-power each are what we require, driving contra-props and accommodated in underslung nacelles designed to give minimum interference with the wing leading-edge.

Buried-engine Cooling

One of the difficulties would be that of supplying cooling air to the radiators during running-up of the engines before take-off. The slipstream from a tractor airscrew meets this requirement adequately and efficiently, whereas the pusher slipstream is lost to the purpose. Nevertheless, this is not an insurmountable difficulty, and there are ways and means of overcoming it.

Mainly for its all-round aerodynamic efficiency a tailless fuselage has much to commend it. A highly efficient finesse ratio is assured, and the wetted surface becomes a minimum, while longitudinal stability is catered for by a stabilising elevator placed forward of the main plane. Located in this manner the elevator would offer but four-fifths the drag of an elevator in the slipstream.

In the interest of safety, high landing speeds are to be condemned, and with passenger-carrying craft added emphasis is lent to the assertion.

There is no reason, however, why an expert, not to say specialised, crew should not be able to handle with safety a highly loaded mailplane even incorporating assisted take-off, and on that premise we might commit ourselves to a wing loading as high as, say, sixty-seven and a half pounds per square foot. The precise form of launching device is immaterial, and could be in the form of rocket propulsion or a gravity accelerator.

The relatively high cruising speed and the resultingly moderate duration may fit in with a crew of only two without imposing too great a strain. On the North Atlantic route the east-to-west crossing would be the most trying, though the alternative South Atlantic route via Bermuda and the Azores would be quite a reasonable proposition. After all, a crew of two flew the Mercury from Dundee to the Orange River, South Africa, in 1938.

The three-view general arrangement drawing in Fig. 4 defines a machine designed round the foregoing specification. Pilot and wireless operator are accommodated forward in the nose of the aircraft, in a pressure cabin. The wireless operator, who will also be navigator, is seated slightly aft of the pilot, and has access to a chart table conveniently located at his left-hand side and immediately behind the pilot. Around this table comprehensive two-way radio and astro navigational equipment is installed. Immediately aft of the crew's quarters would be the mail compartment.

Plastic-bonded plywood construction would be advantageous in providing integral fuel tanks within the wings and certain parts of the fuselage, resulting in a certain economy of weight. Alternatively, conventional metal construction could be employed.

Summing up: It has to be conceded that extensive experiments and wind-tunnel tests would perforce need to be carried out before such a project could be embarked upon, and this would involve considerable time. Nevertheless, given the opportunity and the financial backing, the British Aircraft Industry would prove itself more than equal to the situation.

The tailless type of aircraft has ever appealed to the

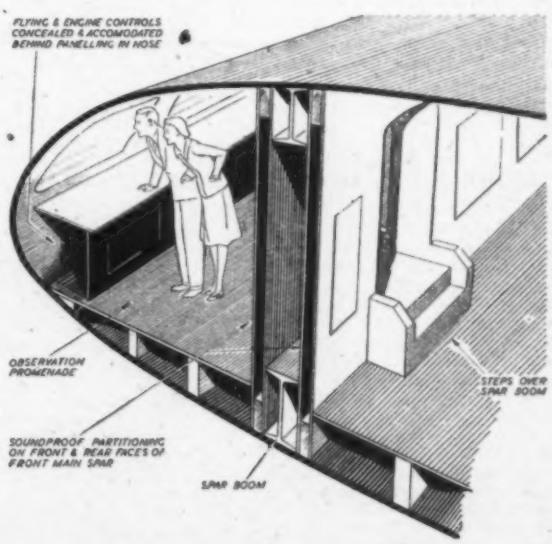

FLYING & ENGINE CONTROLS CONCEALED & ACCOMODATED BEHIND PANELLING IN NOSE
OBSERVATION PROMENADE
STEPS OVER SPAR BOOM
SOUNDPROOF PARTITIONING ON FRONT & REAR FACES OF FRONT MAIN SPAR
SPAR BOOM

Fig. 6. Wing cabin and promenade deck.

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imagination, and to-day we are confronted with at least two examples of this unorthodox arrangement, namely, the Cunliffe Owen Flying Wing and the even less conventional Northrop fighter, both of which have flown.

The former was a bold compromise and was virtually a cabin wing machine retaining the normal empennage carried on two tail boom arms.

The Northrop design puts a rather different complexion on the matter and is basically different. The tail unit is dispensed with, and a back-swept wing with pusher airscrews featured. A fuselage, as such, is not employed but instead the pay-load is housed within the wing. The engines are located aft of this compartment, and it is thought that the arrangement will assist in sound dissipation and result in a more quiet cabin.

The amount of research and experiment that has been put into this enterprise must be enormous, and there will follow an equally extensive flight testing before a final verdict is pronounced. In the meantime, it is possible that other ventures will follow, for there is yet another variant of the scheme which is in principle intermediate between the two foregoing designs and is as shown in Fig. 7.

The layout is self-explanatory, and is intended as a large trans-Atlantic or long-range air-liner using normally aspirated engines or jet propulsion power units The fuselage length has been reduced to a minimum in order to concentrate the loads, and within the fuselage are two large

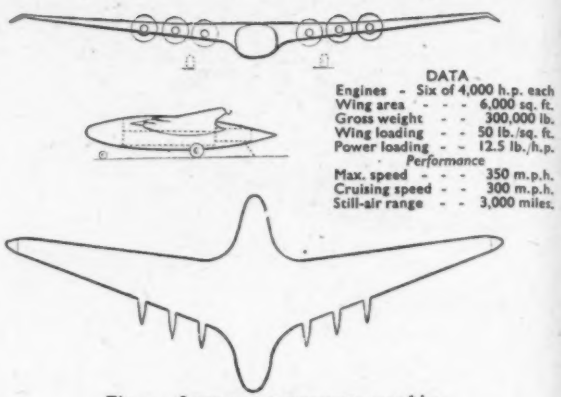

DATA
Engines - Six of 4,000 h.p. each
Wing area - - - 6,000 sq. ft.
Gross weight - - 300,000 lb.
Wing loading - - 50 lb./sq. ft.
Power loading - - 12.5 lb./h.p.
Performance
Max. speed - - - 350 m.p.h.
Cruising speed - - 300 m.p.h.
Still-air range - - 3,000 miles.

Fig. 7. Long-range passenger machine.

cabins arranged transversely one above the other. Engines and fuel, along with some of the load, are placed in the wing, the tips of which are depressed to offer lateral stability. No tail unit is fitted and a consequent reduction of wetted surface and drag effected, flying control being maintained by ailerons only.

The moderate top speed to be expected of this size of aircraft would be consistent with the use of tractor airscrews, since the increased drag of the slipstream would be reasonably tolerable and there would be some improvement in the wing lift under take-off conditions.

Air *versus* Sea Transport

Sir Frederick Bowhill's Views on Their Relative Values in War

AIR transport as we know it can never take the place of ships for the movement of passengers and freight in volume, and its possible use to beat the U-boat menace to ocean ship lanes has been greatly exaggerated, it was asserted in Montreal by Air Chief Marshal Sir Frederick Bowhill, who was A.O.C.-in-C. R.A.F. Ferry Command before he was placed in charge of the recently created R.A.F. Transport Command.

The idea that the threat of enemy submarines could be obviated by the extensive use of cargo planes was a "dream not for us in this war," Sir Frederick told the Montreal Advertising and Sales Executive Club at a luncheon meeting in the Mount Royal Hotel.

"Ships are going to win this war, the ships of the Allied merchant navies," he emphasised. "This war is really a war of communications, especially across the sea lanes. We have got to have ships and we have got to keep them moving to the battle zones."

Using air transport in place of ships would not only require a tremendous number of large aircraft but a vastly greater amount of precious fuel to operate them, he pointed out. A cargo of 6,400 tons could be moved by a 12,000-ton steamship, over a course requiring two months to traverse, with consumption of 425,000 gallons of fuel. A single cargo aircraft could only carry 4½ tons of shipments at a time, so it would require 1,440 flights to move the same cargo carried on the single steamship.

This meant that it would take 10 trips by 144 aircraft to transport the shipment in the same time required for the ship to handle it, Sir Frederick estimated. The total flying involved would total 20,000,000 miles and require 18,000,000 gallons of fuel, of which 15,000,000 would have to be shipped by tanker to be available at refuelling stations and at destination.

MORE A.T.C. OFFICERS TAKE SPECIAL COURSES

DURING April, 350 A.T.C. officers are going through the special administrative courses recently opened at R.A.F. stations. This is the largest number to attend in any month since the scheme was started.

The courses last from one to three weeks, the longer courses being intended mainly for officers likely to become squadron commanders. In addition, there are week-end courses for those whose business or professional ties prevent them taking their instruction in one spell.

Over 800 R.A.F.V.R. officers in the corps have now been through these schools, where special training has been devised to develop the quality of leadership in A.T.C. officers, and through them in their cadets.

The curriculum of the present courses has been largely modelled on suggestions made by the officers themselves. As the time allotted to cover the syllabus is short, these courses are hard work. The first parade is at 7 a.m.; and with drill, lectures and practical instruction of various kinds the "students" are usually kept busy until 8.30 p.m.

A.T.A. BENEVOLENT FUND

SUBSCRIPTIONS to the A.T.A. Benevolent Fund continue to be received by Headquarters. The new list of donations given below is considerably swelled by the first item on the list, one of £900 from Mrs. V. Coleman, who has made this generous donation in memory of her husband, First Officer Alan Coleman, who lost his life in the service of A.T.A. early this year.

Amount last acknowledged (excluding contributions from A.T.A. and B.O.A.C.)	£6,076	7	7
Mrs V. Coleman	900	0	0
The Fairey Aviation Co., Ltd.	250	0	0
Sir Frederick Handley Page	50	0	0
Crofts (Engineers), Ltd., Bradford	25	0	0
L. E. Creagh	10	0	0
Herbert Fitch and Co., Ltd.	5	5	0
Col. P. F. Keene	3	6	4
M. H. Fortlage	2	12	6
Messrs. L. Hepplethwaite	2	2	0
159 Sqn. A.T.C., per H. G. Bradley.....	1	1	0
Scottish Aviation Social and Welfare Club	1	1	0
F. Watkinsons, Ltd.		7	6
J. S. Webber		5	0
	£7,327	7	11

Behind the Lines

From Italy

THE *Officine Moncenisio*, the Italian aircraft company formerly known as *Banchiero*, of Turin, is reported to have recently substantially increased its capital. The company's works are situated at Condove.

Persistence

NEUTRAL sources report that a company for research in rubber-growing in the Ukraine has been founded in Berlin. The prime object of the company is to continue with experiments with the Kok-Sagyz plant, large plantations of which have been previously established by the Soviet Government.

The new company is also to investigate the possibilities of cultivation in the Ukraine of a Mexican fibrous plant which yields 1,500 lb. of fibre and about 100 lb. of rubber per acre.

Fusion

ACCORDING to a German report, the well-known French firm, *Compagnie Aéroplanes Morane-Saulnier*, and the *Avions Kellner-Becherau* have jointly formed a new company. While no details of the arrangement are given, it can be presumed that it actually implies a fusion of the two firms concerned.

Continental Air

AXIS sources report the establishment of a new air service between Vienna and Agram. The latter city is already connected by air with Budapest, while another air service, Agram-Venice-Milan, is operated once weekly in both directions.

The Swedish Air Transport Company, the A/B Aerotransport, is reported to be operating now a service between Copenhagen and Berlin. This route was previously operated by a Danish company, but has been taken over by the Swedes since the accident to a Danish aircraft, *Selandia*, in Vienna. It is understood that the Danish *Det Danske Luftfartselskab* is now overhauling its aircraft *Jutlandia*, and will shortly join the Swedish company in the running of the above service.

For Pocket Money

FOLLOWING Hitler's call for total mobilisation, German boys born in 1926 and 1927 are being called up for service with the *Luftwaffe*. Exemption is granted only for reasons of health, and the boy conscripts, while not considered fully fledged soldiers, will receive the same treatment as soldiers in the case of injury in the course of their duties.

Service and Industrial News from the Inside of Axis and Enemy-occupied Countries

At first they are given eighteen hours' instruction per week, and are being primarily drafted into the *Flak* units. They are paid 0.5 RM a day, are billeted in communal camps, and if—as the German reports put it—"they are loyal and obedient," they will be allowed some home leave.

Female Labour

ACCORDING to a report of the women's section of the Nazi Party, about 2,000,000 women had been mobilised up to the end of 1942. The increase of female labour in the different sections of industry is stated to be quite considerable. Thus before the war, in the metal industry, out of each hundred workers six were women, the figure now being thirteen. In the technical and engineering trade the percentage has risen from 3 to 7.5.

According to the above source, with the further total mobilisation of the labour power, about 16,500,000 to 17,000,000 women are expected to be drafted into industry.

Disturbed Leave

INSTRUCTIONS posted up in public air-raid shelters in Germany state that the Supreme Command of the *Wehrmacht* has ordered that, in the event of an alert, all men of the armed forces on leave must place themselves immediately at the disposal of the A.R.P. service and report promptly to the nearest *Flak* observation post or A.R.P. unit or warden.

In addition, members of the *Luftwaffe* or army going on leave have a written order on their leave passes to report to an A.R.P. centre immediately upon arrival at their destination.

Exodus

WITH the growing intensification of R.A.F. raids on Germany a new wave of migration is reflected in the German Press. Newspaper advertisement columns carry numerous offers of elegant flats and houses in Berlin and other cities, and requests for accommodation in the country.

Nazi bosses in *Unter den Linden* seem to dislike their disturbed nights, as the multiplied offers for exchanges for "quiet and secluded country cottages" seem to indicate.

Ersatz

MANFRED VON ARDANNE, a German physicist, is reported to have invented a process for hardening metals to a very high degree. German reports stress the special significance of this invention, because it is said to produce metals capable of replacing industrial diamonds.

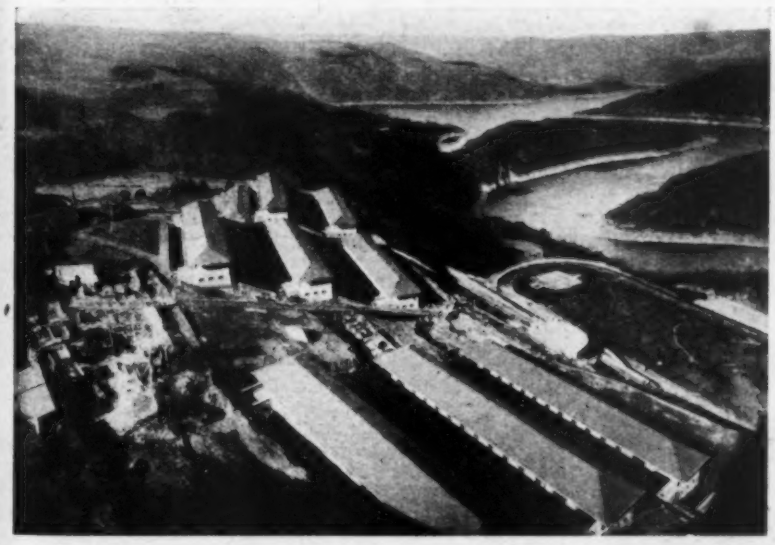
From Japan

KAWASAKI, one of the leading Japanese firms controlling a number of heavy industry enterprises and aircraft works, is attempting to increase its share capital from 200,000,000 to 600,000,000 yen. Half of the new issue of shares are being offered to old shareholders, the balance being placed in the open market.

Paratroops

GERMANY'S efforts to mobilise to the full extent the man-power resources of her satellites are not confined to industrial workers. While, hitherto, troop contingents supplied by the different satellite Governments were composed of formations of their usual branches of army and air units, a novelty is the formation of parachutist groups.

In Hungary, *Honveds* are being drafted for this purpose and are now under training. Noticeable also is the increased encouragement given by German authorities to gliding training, as, for instance, in Bulgaria and in Rumania, where four training centres under German instructors are reported to be in existence.



WHERE THEY BREED: An air view of the training centre for S.A. leaders at Vogelsang, in the Eifel, now taken over by the military.

Lockheed Production

Wheels, Brakes and Hydraulic Control Systems : Engine-driven Pumps : Self-sealing Couplings

AN American tinge in the title of the Automotive Products Co., Ltd., suggests that a connection with the United States originally existed. It is not, therefore, altogether surprising to find that the company began life as an organisation for importing American motor car components for distribution in this country and the Continent. The company was of inter-war inception, having been formed in 1920, and at that time was in no sense concerned with manufacture. The first step which set it on the road to becoming a large-scale organisation for the production of automobile and aircraft equipment was the acquisition of the European rights of the American Lockheed hydraulic braking system. At first these units were also imported, but their growing popularity in the motor industry led to the decision to manufacture over here. As a result, production in a small factory, which is now the company's research department, was begun in 1928. Demand for their products from the expanding motor car industry led to rapid growth of the manufacturing side, and in 1931 the company moved to its present works which, in the last twelve years, have greatly increased in area.

At present the group of companies comprises, in addition to Automotive Products, the Lockheed Hydraulic Brake Co., Ltd., the Borg and Beck Co., Ltd., and Avery Equipment, Ltd. Borg and Beck clutches have also been manufactured in this country since 1932. Each member company has its separate shops, production and sales organisation, but their activities are co-ordinated by group managements.

Airdraulic Legs

The entry of the Automotive group into the aircraft field was brought about by the adoption of hydraulic equipment for aircraft. This development led to the introduction of the Lockheed hydraulic system of controls, which achieved considerable success. Very shortly afterwards Lockheed Airdraulic undercarriage legs made their appearance, and it is with these that the company's name is probably most usually associated in the aircraft world. The acquisition of Avery Equipment, Ltd., manufacturers of the Avery wheels and brake unit, made it possible for the group to undertake the manufacture of complete undercarriages.

Beaufighter undercarriage legs ready for delivery.

Lockheed undercarriages are being supplied for several current types of aircraft, including the Defiant, Beaufighter and Airspeed Oxford, as well as for others still on the secret list. In addition, a considerable amount of overflow from other companies' works is also being handled. Production of these units is allocated to a group of two immediately adjoining shops devoted respectively to manufacture and assembly.

Testing Avery self-sealing couplings under pressure.

Machine Shop

Machining is classified as light or heavy, roughly one-half of the machine shop being given to parts of each class. Finished parts are sent to the stores, located at the machine-shop end of the assembly shop, between the two departments. From the stores the parts are issued as required directly on to roller runways which extend down the length of the assembly shop between the work-benches. Operatives are, in this way, supplied with all their requirements with a minimum waste of effort and without the need for truck transport which frequently does so much to congest the average workshop.

A friendly feature of the undercarriage shops is the light overhead conveyor which makes its sedate and even stately progress through both machine shop and assembly departments, calling *en route* at the various stores and reappearing in a solemn, unhurried manner which is curiously reassuring. By inserting a pin into one of a series of holes in the suspension bar of each platform, a bell is caused to ring at the appropriate station for unloading. Rumour has it that when it was first introduced the conveyor was used largely for the exchange of playfully unparliamentary messages between different sections of the shops.

The selector-valve associated with the Lockheed hydraulic

LOCKHEED PRODUCTION

control system is an excellent example of work involving production to very close limits of accuracy. A typical unit is the three-lever type for hydraulic operation of flaps, undercarriage and bomb-doors. This unit was designed to require a minimum of attention on the part of the pilot, and when any lever is moved it remains in the selected position until the operation which it controls is completed, when it reverts automatically to its neutral position. The high pressures involved necessitate an extremely high standard of accuracy in the finishing of the valve plungers. Selective assembly is, of necessity, used in these operations, the plungers being finally lapped in to their seatings in the valve-casing.

Engine-driven pumps for Lockheed control systems also involve much high-precision work and are produced in a separate shop laid out for the purpose and containing also the rigs for testing.

Another component produced by the group is the Avery self-sealing coupling, which might be described as the answer to a plumber's prayer. The special feature of this coupling is that it permits any pipeline containing fluid to be broken and remade without loss of fluid and without introducing any air into the system. The design is such that the pressure in the system tends to maintain the halves of the coupling in contact and, in consequence, leaks cannot develop as a result of vibration or mishandling in service.

A special section of one of the shops is laid out for the production, testing and inspection of these couplings, and it is interesting to note that, apart from supervising staff, it is operated almost entirely by women.

In common with all other industrial concerns at the present time, the Automotive group have taken in a large number of women workers, for whom an instructional scheme is operated. Upon their arrival at the works they are sent to a special investigation department, in which an endeavour is made to assess their special aptitude or abilities, after which they are employed upon the type of work to which they appear to be most suited. Those who show particular skill or aptitude are encouraged to train for higher grades of employment, and suitable instructional courses are arranged for this purpose.

Undercarriage salvage. The legs are stripped and all undamaged parts re-used.

An account of the activities of the aircraft side of the group would not be complete without some mention of the salvage department. This section has been developed very considerably during the war and now performs the most valuable function of supplementing new production by reducing to a minimum the number of units written off as scrap.

Undercarriage legs damaged in crash landings or other accidents are returned here from the Service depots and stripped down for examination. Wherever possible, the complete unit is reconditioned by the replacement of damaged or broken parts, but where this is impossible the entire assembly is dismantled and any parts which can be used again are cleaned and stored. Everything possible is done, consistent with safety, to reduce the amount of material scrapped to the smallest possible limits.

WEST OF SCOTLAND AIRPORT POLICY

A RESOLUTION that there should be an international airport in Scotland was recently approved in Glasgow at a conference held under the auspices of the Clyde Navigation Trust, Mr. William Cuthbert, chairman of the Trust, presiding. Several West of Scotland local and other authorities, including Glasgow Corporation, were represented, and all representatives who had the requisite authority approved the resolution, which was moved by Mr. J. Wilson Paterson and seconded by Sir Henry Keith, both members of Lanark County Council.

The object of the meeting was to reach an agreed general policy, and there was a full discussion. Mr. Cuthbert said the Prime Minister's recent speech had made it clear, and he thought all would agree with him, that although our first and paramount interest must be the winning of the war, arrangements and investigations ought to be proceeded with, so that we might be able to tackle the more important post-war problems as and when they emerged. He was aware that other public authorities had been giving consideration in recent years to the effect of developments in aviation, but the experience gained in the war made it obvious that whenever hostilities ceased there would be a tremendous advance in peacetime flying for commercial and pleasure purposes. He thought it was of urgent importance that the unique advantages which the West of Scotland afforded for an international airdrome and possibly subsidiary airdromes should be impressed on the Government, and that they should now give full consideration to the part which the West of Scotland must play in any such developments.

Mr. Cuthbert added that the Clyde Trust, in common with other harbour authorities, provided dock facilities for the arrival and departure of ships serving the trade of the world. On the Clyde ships were built, repaired and serviced in every way. It seemed logical that the Clyde Trust should consider the subject of world transport by air and the provision of an airdrome and service facilities, irrespective of whether such facilities could be provided within the boundaries of the undertaking of the trust.

A global airport for post-war aviation was approved in principle at the conference and instructions were given for a committee to prepare a report on the possibilities of catering for land and sea aircraft. The chairman said that the importance of West of Scotland in shipbuilding and engineering and supplementary services gave it a right to be considered as a centre for international air traffic. The question of sites would be considered by the committee, in association with experts, and it was believed that the ultimate aim would be to secure the national ownership of airfields for international and interior traffic.

Developments in the past had been hindered by competing local authorities anxious to have airports within their territories. It was hoped that now co-operation would be obtained with Government approval for major schemes to serve the whole of Scotland.

"The Clyde Trust is acting as mediating organisation and does not seek to be the owner or controller of whatever airfields may be approved by the State," he said. "Certain interests in the South are not too favourable to Scotland being included in whatever post-war plans the Government may have for the construction and operation of aircraft, but if the West of Scotland combines its industrial, economic and political influence it will be difficult for the South to prevent it getting its rightful place in the world of aviation."

CORRESPONDENCE

The Editor does not hold himself responsible for the views expressed by correspondents. The names and addresses of the writers, not necessarily for publication, must in all cases accompany letters.

MEN TO REMEMBER

Unposted 1918 Air Crew Have No Ribbons

IN the postscript on Sunday, March 28th, Sir Archibald Sinclair asked that pilots and observers of 1918 should be especially remembered at the twenty-fifth anniversary of the Royal Air Force.

I would bring to your notice that any pilot or observer in 1918 who had not been posted overseas or to an aircraft carrier has no war ribbon awarded to show that he took any part in the last war.

As many of these gallant airmen are again serving with the R.A.F., would it not be possible to issue them with the Victory Medal in recognition of their services?

"JUSTICE."

THE GOLDFISH CLUB

Membership Conditions Too Narrow

SOME publicity has been given to the formation of a Goldfish Club open to those who have saved their lives by using their rubber dinghies. So far as I can see no provision has been made for those who avoided a watery end by other means. Sometimes, for various reasons, the dinghy "didn't work" and the crews did it the hard way, hanging on to a piece of aircraft that might sink any moment. My crew had nearly an hour of this tingling expectancy before the Navy turned up. Fortunately, a cruiser saw us go in.

The Goldfish Club, if open only to dinghy users (should I say dinghy advertisers?) is in its present form not representative of those who have ditched or been ditched.

PER ARDUA AD MARE.

TAILPLANE DIHEDRAL

To Avoid Buffeting Vortices

WITH respect to the correspondence in the March 18th issue of *Flight* concerning tailplane dihedral angles submitted by "Interested," I wish to point out the following facts:

This method is applied to an aircraft to keep the tailplane as clear as possible from the buffeting vortices created by the engine nacelle, these vortices combining with those set up by the fuselage to form two very turbulent streams of air travelling somewhere between these two masses. If the tailplane and elevators were placed in these streams or in close proximity to them the vibration or flutter set up would be tremendous and would also make elevator control very heavy indeed. On a machine such as the Douglas Boston, the tailplane is given a very large angle to place it above these vortices and therefore cut down tail flutter and lighten the elevator controls.

Obviously, an arrangement such as the crucifix tailplane setting of the Westland Whirlwind is the best, but this presents very great structural difficulties, otherwise it would be more often used.

G. E. D. ROSS.

THE FIGHTING FORTRESS

Air-combat Figures "Conservative"

IT hardly seems to me that your paper has taken sufficient notice of the extraordinary exploits of the Fortresses. Not only do they bring down enormous numbers of German fighters, but their own losses are remarkably small. It looks as if the Germans have no reply to this particular machine. If so, either they could be used as fighter cover for our big four-engined bombers, or else we could use them exclusively for bombing. I am aware that they do not carry the load that the larger machines do, but it merely means more journeys.

I am aware that a considerable number of people minimise the published results, suggesting that they are exaggerated, but the Commander of the United States Air Force in this country took very particular care to point out in his latest figures that they were of a conservative nature.

In point of fact, a Fortress appears to deal better with the fighters than do our own fighters. Either the figures are exaggerated, in which case the facts should be published, or, if not, then the Fortresses should be given due credit for their really extraordinary exploits.

E. N. BRAY.

AID TO NAVIGATORS

Vector Calculators on Instrument Panels

HAVING become acquainted with several R.A.F. air crew observers during the last twelve months, I have often been asked why designers do not accommodate navigation computers in some form of instrument panel.

This seems to be quite a reasonable question, since there is little enough table-room available to these important airmen.

I am employed by a company which manufactures vector calculators of a type which could easily be fitted and operated in an instrument panel, but since their output of calculators is comparatively small when compared with the quantity used by the Royal Air Force, it is possible that the mounting question has been overlooked.

I have suggested this improvement to them and would also like other manufacturers to consider this point when planning their designs, since the idea has emanated from several R.A.F. fellows as a beneficial aid.

R. F.

EX-R.A.F. PILOTS

Extension of "B" Licence to a Particular Type

"DOUBLE D.F.C." (*Flight*, March 25th) received a characteristically cautious reply from the Air Ministry when he enquired from them whether he would be excused the flying tests required by the directions; but he *was* excused, and I see no reason why he should put the wind up other applicants.

I do not think that any R.A.F. pilot of experience would be required to demonstrate his flying abilities in order to satisfy the requirements for the original "B" licence. The extension of the licence to a particular type is likely to appear more troublesome to the ex-R.A.F. pilot.

The normal procedure was that the applicant took his "B" licence on a small and simple aircraft, very often a D.H. Moth. This licence, although it entitled him to fly a Moth for hire or reward, was not much use in practice and had to be extended to the particular type which he wished to fly. To qualify for this extension the "B" pilot had to demonstrate his ability to fly the type and to pass a technical examination designed to show that he had a sufficient knowledge of its construction and operation.

His employer, or prospective employer, was usually ready to provide him with both the experience and the aircraft for the flying tests. These are simple, and it is only necessary that he should make three landings light and three loaded in the presence of a "B" licensed pilot, whose certification he forwards with his application for extension. The applicant does not find the technical examination difficult if he understands the functioning of the aircraft and its equipment so far as is necessary for its safe operation.

T. R. THOMAS.

THE BEST TYPES OF AIRCRAFT

Concentrate on Heavy Bombers

AN amazing thing about the recent correspondence, started by "Ex-R.F.C.," regarding the best types is the almost unanimous vote for certain types, the Lancaster, Spitfire (V or IX), Hurricane, Mosquito and Typhoon, Beaufighter and Curtiss Helldiver. With the exception of certain specialised types for the Navy, oversea patrol, etc., it would seem obvious that concentration on mass production of these types is essential, never forgetting, however, that all experimental departments must continue free and unfettered to perfect and design new types.

It is clearly futile to fiddle about with other types when the above-mentioned machines have proved their worth, and it is a real pity that the great production machine of the United States is turning out types which really don't quite make the grade. The Fortress and Liberator are good machines, but they do not compare with the Lancaster in bomb load, speed and range, figure for figure. At the expense of a little of its bomb load the Lancaster could easily bristle with 0.5 machine guns and act as a day bomber, while with Merlin 61 engines and a pressure cabin it could outfly the Fortress at altitude.

Even Americans agree about the superiority of British types, as Seversky has bluntly pointed out, unpalatable as this may be to his colleagues in U.S. aviation. Allan Michie, in his book *Germany Can Be Bombed to Defeat*, states the same

CORRESPONDENCE

facts, and draws his facts from experience gained while acting as war correspondent with the R.A.F. since 1940.

Here I would venture into what may be called rank heresy and state that though bombing obviously cannot win the war alone, it can and will be the decisive factor to a far greater degree than is apparently believed in official quarters.

Whatever strategy is adopted, or plans implemented, 10,000 or 20,000 heavy bombers (Lancasters or Stirlings) would be a colossal asset; whereas I cannot see one quarter the value in the obsolete and obsolescent types we still use.

Further, I cannot for the life of me see why the heavy bomber (perhaps slightly adapted) cannot be used for low attacks and close support, in addition to its present longer-term strategic use. When things went badly in Central Tunisia several weeks ago Fortresses successfully joined the smaller types in low-level attack.

After all, bombers are only long-range artillery, and the preliminary to any operation is a "softening-up" by artillery barrage. Add to the artillery a thousand Lancasters' bomb loads and the softening-up might be so severe that the Army would only need to do a little mopping up. The mere threat of a 10,000-bomber raid on Germany might start a squeal for peace. Debatable, but worth trying.

I do not suggest for a moment that fighter production should be interfered with in any way to produce these vast numbers of heavies, but that production should be shifted from medium and light bombers (except the Mosquito) as they are an inefficient method of ferrying explosive and should be discarded. Neither should naval types be diverted, nor transport aircraft, but there are so many varied machines without any particular purpose or performance with which we could dispense.

I submit this for what it is worth, and hope perhaps it will stimulate interest. ERNEST P. BRODIE.

ROTATING-WING AIRCRAFT
Theory of Auto Rotation

WITH reference to your article on the Rotating Wing Aircraft, can any reader explain in simple language what causes the rotation of wings mounted to revolve in the same plane as the direction of the relative wind? I have read many articles about gyroplanes and have never seen this explained. Perhaps I am very slow on the uptake, but I know there are many others in the same boat as myself in this respect.

It seems to me that if air acts on a plane mounted as in a gyroplane, the blades will in any case tend to revolve in the opposite direction required for lift, but even if, as must be the case, this is not so, I cannot see how sufficient, or any, power can be developed in order to turn the blades fast enough to give adequate lift, and in the case of a gyroplane coming down vertically, why do not the planes stop altogether?

The theory of the helicopter is, of course, straightforward enough, but I cannot see how the small amount of air that can in point of fact act in a horizontal direction on the planes of a gyroplane makes up for the engine power directly applied to the vertical airscrew of the former. "R.N.A.S."

Book Reviews

"What's the Gen?" By "HW." Illustrated by "Stacey." John Crowther. 1s. 3d.

EVERY Command and every squadron of the R.A.F. all over the world contributes its quota to the jargon of the Service, and this booklet is an alphabetical glossary of Air Force slang terms copiously illustrated with humorous sketches. It is at once informative and entertaining.

"Adastral Bodies." By Basil Boothroyd. Illustrated by C. F. Greatbach. Allen and Unwin. 5s.

THERE have been many books by and about the men who fly with the R.A.F., but this humorous book by a regular contributor to *Punch* deals in highly entertaining (and sometimes slightly libellous) fashion with air force life as the erk, or sprog, experiences it; but embryo recruits will not, we feel sure, be unduly discouraged.

"The Air Cadets' Handbook on Radio." By I. R. Vesselo and R. D. Morrison. Allen and Unwin. 2s.

DESIGNED for A.T.C. students, this little book first of all explains the elementary principles of electricity and then describes its application to the practical use of radio on aircraft. It is written in simple language and clearly illustrated by many diagrams.

"D/F Handbook for Wireless Operators." By W. E. Crook. Pitman. 3s. 6d.

THE qualified wireless operator will find this exposition on the rotating frame and fixed-loop systems most informative, since special attention has been devoted to various sources of error which arise and other practical difficulties.

"Aircraft Radio." (Second edition.) By D. Hay Surgeoner. Pitman. 15s.

THE scope of this book is wider than its title suggests, for it deals not only with the different types of radio equipment as applied to aircraft, but with such matters as international radio regulations, allocation of wavelengths, directional systems, beam approach and airport equipment and lighting.

"The Revolving Heavens." By Reginald L. Waterfield. Duckworth. 8s. 6d.

ALTHOUGH this is not directly concerned with astro-navigation, it follows that an understanding of the characteristics and movements of the bodies in the celestial sphere would be useful background information for any potential navigator. This book describes phenomena which can be seen with the naked eye.

"The Morse Code." By R. G. Shackel. Longmans. 1s.; and "Practical Morse." By John Clarricoats. Pitman. 1s. 3d.

THE former booklet confines itself to instruction in the code but the latter extends its scope to advice on signalling by Morse and descriptions of practice equipment.

"Laughs with the R.A.F." Compiled by S. Evelyn Thomas. Harrap. 1s.

THIS collection of jokes, cartoons and comic verse will while away half an hour very pleasantly. Due acknowledgment is made by the compiler to a number of periodicals and other publications from which most of them have been culled, including the special Christmas pages of *Flight*.

"Aircraft of the Fighting Powers." (Vol. 3.) Compiled by H. J. Cooper and O. G. Thetford. Edited by D. A. Russell. Harborough Publishing Co., Ltd. 12s. 6d.

IN continuing the good work begun in volumes one and two, Messrs. Cooper and Thetford have again produced a very useful reference book. It contains the latest available data and much general information on eighty-one different types of aircraft, each of which is photographically illustrated and accompanied by sets of three dimensional drawings, and a great deal of careful work must obviously have been done by the compilers to ensure accuracy over such a generous list.

One thing one immediately notices about this book is that almost half of it is devoted to American aircraft, the remainder being more or less equally divided between British (seven types), Russian (nine), German (seven), Italian (six), Netherlands East Indies (eight) and Japanese (nine). In fact, four of the eight aircraft under the N.E.I. heading are American types, making thirty-nine out of the eighty-one aircraft in the book.

However, the first two volumes contained, between them, fifty-four British types, so it cannot be alleged that Britain has been neglected, for there is no modern type of any importance, up to and including the Mosquito, which has not been included in the three books, having regard to the dictates of censorship.

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IN THE BLUE : A trio of Airspeed Oxfords in formation above the clouds

SERVICE AVIATION

Royal Air Force and Fleet Air Arm News and Announcements

New Vice-Chief of Air Staff

AIR MARSHAL SIR DOUGLAS C. S. EVILL has been appointed Vice-Chief of the Air Staff in place of Air Vice Marshal C. E. H. Medhurst, and will have a seat on the Air Council.

Born in 1892, Air Marshal Evill, after serving in France, became senior Air Staff Officer of Fighter Command in August, 1940, and succeeded Air Marshal Harris as head of the R.A.F. delegation in Washington in February, 1942.

Promotion

TECHNICAL BRANCH.

Air Comdre. (temp.) H. I. T. BEARDSWORTH, C.B.E. is granted the rank of Group Capt. (war subs.). December 19th, 1942.

Awards

Fleet Air Arm

THE KING has been graciously pleased to approve the following awards. For gallantry in air operations during the passage of an important convoy to Malta :—

Distinguished Service Cross

Temp. Act. Sub. Lt. (A) P. J. HUTTON, R.N.V.R.

Mention in Despatches (Posthumous)

Temp. Sub. Lt. (A) M. HANKEY, R.N.V.R.

Mention in Despatches

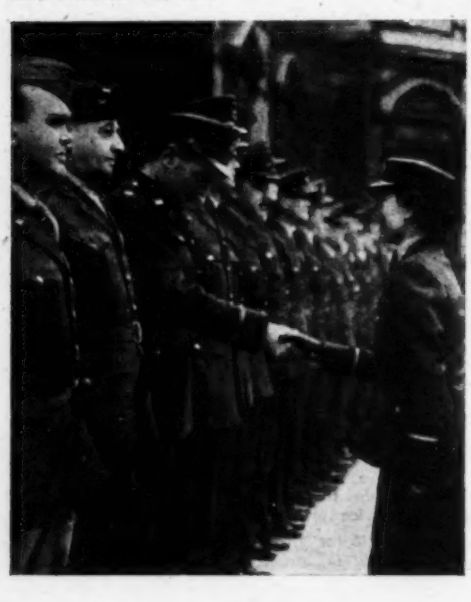
Act. Sub. Lt. (A) D. J. MCDONALD, R.N.

Royal Air Force

THE KING has been graciously pleased to approve the following awards :—

George Cross (Posthumous)

Sgt. G. L. PARISH.—Sgt. Parish was the navigator of an aircraft during a delivery flight from the United Kingdom to the Middle East Command. Shortly after taking off from an airfield in Anglo-Egyptian Sudan one morning in September, 1942, the port engine failed and the pilot attempted to return and land on the airfield. Owing to the rough nature of the ground, full use could not be made of the brakes. The aircraft struck a building on the airfield and immediately burst into flames. All of the crew with the exception of Sgt. Parish and a passenger, whose legs were both broken, succeeded in getting free of the blazing bomber. At the time of the crash Sgt. Parish was at the astro-hatch and the passenger was at the emergency door which is in the floor of the fuselage. This door was unusable, as the undercarriage had collapsed and the fuselage was resting on the ground. The fire, which completely destroyed the bomber, was so intense that no assistance could be given to the navigator or the passenger. When the blaze subsided, Sgt. Parish's body was found leaning against the rear gun turret and the passenger was beside him with his arm over the airman's shoulder. As the passenger could not walk, owing to his broken legs, it is clear that Sgt. Parish had carried him from the emergency door to the rear turret, a distance of eight yards, in the hope that both could escape through the turret. Undoubtedly both were overcome and burned to death in the attempt. Sgt. Parish could have made his escape through the astro-hatch, but his unselfish desire to assist the passenger cost him his life.



Air Commandant—now Air Chief Commandant — the Duchess of Gloucester at Combined Operations Headquarters.

THE KING has been graciously pleased to approve the following awards in recognition of gallantry displayed in flying operations against the enemy :—

Distinguished Flying Cross

F/O. G. A. TURNER, R.A.F.V.R., No. 107 Sqn.—One day in November, 1942, F/O. Turner and Sgt. Liddle were pilot and navigator respectively of an aircraft detailed to attack an industrial plant at Ijmuiden. Whilst over the target area the aircraft was hit by anti-aircraft fire. A shell, bursting in the navigator's cockpit, caused much damage and wounded Sgt. Liddle on the face and in the arms, chest and leg. Despite this, F/O. Turner pressed home his attack, and Sgt. Liddle, disregarding his injuries, released his bombs on the objective. In the face of many difficulties F/O. Turner, gallantly supported by his navigator, flew the damaged aircraft back to an airfield in this country and landed safely.

Act. Flt. Lt. B. W. BONE, R.A.F.V.R., No. 106 Sqn.—During a number of months of operational flying Flt. Lt. Bone has navigated his aircraft with great skill and success to objectives in the Ruhr, Hamburg and Bremen. He has also flown on mining operations and in attacks against Italian targets. Recently he flew to Berlin.

Act. Flt. Lt. W. M. BURNSIDE, R.A.F.V.R., No. 106 Sqn.—Flt. Lt. Burnside has navigated his aircraft to many targets in the Ruhr, on mine-laying flights, and on three occasions to Italy. The accuracy of his navigation has been proved by the high percentage of successful sorties and by the photographs secured.

Act. Flt. Lt. J. H. DUNK, R.A.F.V.R., No. 35 Sqn.—In all his many sorties, this officer has displayed the utmost keenness and enthusiasm for operations against the enemy. Despite the heaviest of enemy defences or the most adverse weather, his navigation is invariably faultless. This was particularly evident during a daylight attack on the submarine yards at Danzig, where very thick cloud, icing and bad visibility made the mission very hazardous.

Act. Flt. Lt. A. E. FOSTER, R.A.F.V.R., No. 61

Sqn.—This officer played a conspicuous part in the two daylight raids on Le Creusot and Milan. In September, 1942, while participating in an attack on Dusseldorf one engine of his aircraft was hit by enemy defences and set on fire. Displaying coolness and determination Flt. Lt. Foster extinguished the fire and continued his attack.

Act. Flt. Lt. C. A. GILES, R.A.A.F., No. 61 Sqn.—Flt. Lt. Giles has displayed great skill as a navigator throughout many sorties. By his quiet confidence and excellent example he has raised and maintained squadron navigation to a high level. Recently, as captain/navigator, he successfully led two new crews on raids on Munich and Essen. He also participated in a raid on Berlin in January, 1943.

Act. Flt. Lt. J. A. HARRISON, R.N.Z.A.F., No. 10 Sqn.—In March, 1942, this officer was involved in a serious crash and sustained head injuries, a broken arm and crushed foot. Undeterred by this experience, Flt. Lt. Harrison returned to operational duties immediately on his discharge from hospital, and has since taken part in numerous sorties in the face of severe enemy opposition. Over Dusseldorf in September, 1942, his aircraft was held by searchlights and badly damaged by anti-aircraft fire. In November, 1942, whilst returning from Turin, his aircraft was repeatedly attacked by an enemy fighter, which was eventually destroyed by his rear gunner.

Act. Flt. Lt. A. G. LANG, R.A.F.V.R., No. 156 Sqn.—This officer has participated in numerous operational sorties against targets in Germany and Italy. He has always displayed exceptional ability and has consistently set a high example of courage and determination.

Act. Flt. Lt. E. M. LEWIS, R.A.F.V.R., No. 102 Sqn.—By his skill, careful planning and meticulous attention to detail Flt. Lt. Lewis has contributed much to the successes achieved by his crew. It is entirely due to his systematic and careful training of bombardiers that such excellent results have been achieved.

Act. Flt. Lt. R. H. LUNNEY, R.A.F.V.R., No. 7 Sqn.—Flt Lt Lunney has consistently navigated his aircraft to well-defended and distant targets with a high degree of precision. His outstanding ability as a navigator has been demonstrated many times under difficult circumstances.

Act. Flt. Lt. J. MACPHERSON, R.A.F.V.R., No. 156 Sqn.—By his outstanding ability and knowledge as a navigator, this officer has ably assisted his captain during numerous sorties. He has achieved a very high standard of operational skill and invariably takes the utmost pains in identifying and attacking the target.

Damaged Over Lubeck

Act. Flt. Lt. A. McP. OGILVIE, R.A.F.V.R., No. 83 Sqn.—When this officer's aircraft has been severely damaged by enemy action he has always succeeded in completing his mission, though on one occasion, over Lubeck, the rear and mid upper gunners were both seriously wounded, and the aircraft was very difficult to control. During an attack on the Ruhr in April, 1942, intense and accurate anti-aircraft fire seriously wounded the pilot, who collapsed. Flt. Lt. Ogilvie was able, by cool and efficient navigation, to direct the aircraft safely to land in this country.

Act. Flt. Lt. E. L. PORTER, R.A.F.V.R., No. 207 Sqn.—This officer has taken part in a large number of operational sorties, many of which were against heavily defended targets. He also successfully participated in the daylight attacks on Danzig and Le Creusot. On a number of occasions, by the quiet, cheerful and efficient way he has overcome difficult situations, he has won the admiration of all.

Act. Flt. Lt. R. M. REES, R.A.A.F., No. 83 Sqn.—Flt. Lt. Rees has a long and distinguished record of operational flying. On one occasion during a daylight attack on Danzig he displayed superb navigational ability. In appalling weather, with constantly changing winds, he located the target and the attack was pressed home from below 1,000 feet, many hits being obtained. On another occasion recently, while on the return journey from Berlin, this officer's aircraft was engaged by ground defences and two engines were put out of action. With great skill Flt. Lt. Rees navigated the crippled aircraft many hundreds of miles back to base.

Act. Flt. Lt. K. D. ROMZ, R.A.F.V.R., No. 35 Sqn.—The regularity with which this officer has successfully attacked enemy targets is outstanding, and he has shown a most commendable skill and a fine fighting spirit. His great determination and courage have had an inspiring influence upon the other bomb aimers in his squadron.

Act. Flt. Lt. N. H. SCRIVENER, R.A.F.V.R., No. 106 Sqn.—This officer has completed many operational sorties, in the course of which he has made many attacks on enemy industrial targets in Germany and Italy. He participated in sorties against Essen and Berlin, and also in the daylight raid on Milan in October, 1942. As Squadron Navigation Officer he flies regularly with new crews in order to give them the benefit of his ability and experience.

Act. Flt. Lt. G. B. SINGLEHURST, R.A.F.V.R., No. 542 Sqn.—During operational sorties completed with this Squadron, Flt. Lt. Singlehurst has obtained results far above the average. He has participated in many flights involving long sea crossings in adverse weather.

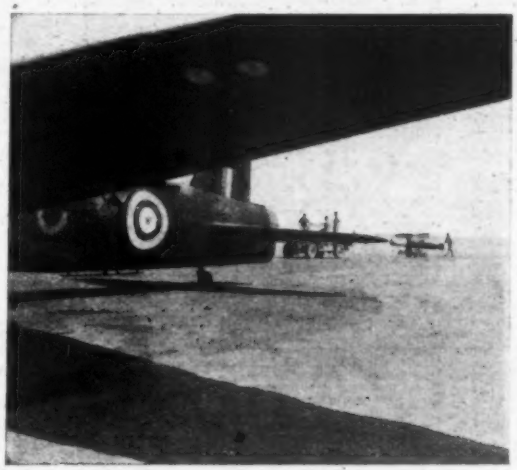
SERVICE AVIATION

Act. Flt. Lt. R. I. TRICKETT, R.C.A.F., No. 35 Sqn.—The majority of the operational sorties on which this officer has been engaged have been attended with marked success, due largely to his determination to press home his attack, and to his ability as a navigator.

Act. Flt. Lt. A. E. WEBSTER, R.C.A.F., No. 35 Sqn.—Flt. Lt. Webster's work as a navigator has been outstanding, and only equalled by his courage. On one occasion, when his aircraft was attacked by enemy fighters and the wireless operator badly wounded, he coolly and effectively administered first aid. Although handicapped by a damaged chart table, chair and instruments, he navigated the aircraft safely back to base. He again displayed exceptional coolness and imperturbability when his aircraft struck the trailing aerial of another, which smashed the front turret and tore his clothes.

F/O. D. W. CARMICHAEL, R.C.A.F., No. 104 Sqn.—F/O. Carmichael has taken part in a number of operational sorties. He is an observer of exceptional ability as well as a keen and accurate bomb aimer. One night in November, 1942, he was largely responsible for exploding an ammunition dump at an enemy airfield in Sardinia.

F/O. N. J. COOPER, R.A.F.V.R., No. 502 Sqn.—In November, 1942, F/O. Cooper was captain of an aircraft engaged on anti-submarine patrol. On the French coast severe damage was sustained from anti-aircraft fire. Shortly afterwards an enemy motor vessel heavily escorted was sighted. Despite the fact that the aircraft could be controlled only with great difficulty, F/O. Cooper made every effort to bomb the ships. On the return flight it was evident that landing would be a hazardous task. It was accomplished successfully by the superb airmanship displayed by F/O. Cooper.



DESERT STUDY : Armourers wheeling out a torpedo to one of the Wellingtons used for attacks on shipping in the Mediterranean.

F/O. G. R. CRACKANTHORP, R.A.F.V.R.—Many of this officer's operations have been completed in the face of adverse weather and enemy opposition. On one occasion he returned to his base after a long reconnaissance, to find that a landing was almost impossible due to low cloud. Nevertheless, displaying superb airmanship, F/O. Crackanthorp effected a safe landing with a very narrow margin of petrol remaining. This officer has specialised in long distance reconnaissance flights, and many of his missions have been to distant areas, thereby requiring great endurance and navigational skill.

F/O. M. D. DELOFORD, R.A.F.V.R., No. 49 Sqn.—This officer has successfully completed operations against targets in Germany, Greece, North Africa, Sicily and Italy, which have necessitated faultless navigation. F/O. Deloford has displayed great determination and gallantry.

F/O. F. E. DREW, R.A.F.V.R., No. 106 Sqn.—F/O. Drew has displayed great navigational ability throughout his many operational sorties against targets in the Ruhr, Nuremburg, Munich, and on mine-laying expeditions. Recently he has flown to Genoa and Turin. He also participated in the daylight attack on Milan.

F/O. H. EDWARDS, R.A.F.V.R., No. 7 Sqn.—This officer has taken part in many operations in heavy bomber aircraft. He is a most valuable member of his squadron, both in the air and on the ground.

F/O. D. F. GORDON, R.A.A.F., No. 133 Sqn.—This officer has been continuously engaged on operational duties during the past ten months, and throughout has displayed a fine fighting spirit. He has taken part in a successful raid on Bangkok, and in a daring low level attack on shipping at Akyab.

F/O. A. S. GRANT, D.S.O., R.A.A.F., No. 49 Sqn.—This officer's keenness in the air and on the ground has been of the highest order, and his determination and efficiency have contributed largely to the successes attained by his crew. On one occasion, during a raid on Genoa, the compasses became unserviceable, and it appeared that the flight might have to be abandoned. By his skilful use of astro-navigation, F/O. Grant overcame the difficulties, and directed the aircraft to the target and back to this country.

F/O. C. B. MCGHEE, R.A.F.V.R., No. 26 Sqn.—Throughout his many operational sorties, F/O. McGhee has displayed a high degree of efficiency and great courage in action. In September, 1942, despite considerable anti-aircraft fire, he secured some excellent photographs of the French coast. This officer took part in the combined operation at Dieppe, and has made successful low-level attacks on enemy transport, gun positions and infantry.

F/O. R. A. MCKINNA, R.A.F.V.R., No. 156 Sqn.—F/O. McKinna is a conscientious and reliable officer who has flown on a number of operational sorties against targets in Germany and enemy-occupied territory.

F/O. A. F. MACQUEEN, R.A.F.V.R., No. 83 Sqn.—This officer has taken part in a large number of operational sorties, the majority of which have been against the most heavily defended targets in Germany. In July, 1942, he flew on a daylight operation against the submarine yards at Danzig. Despite appalling weather, the target was located and bombed from 2,500 feet. On the return journey F/O. MacQueen machine-gunned searchlights and gun positions. Later he participated in a daylight attack on a target in the Ruhr. On the outward journey his aircraft was attacked by two Fw 190s, and it was entirely due to this officer's coolness and skill in directing evasive action that his aircraft avoided damage. Later when engaged by powerful ground defences it was again to his credit that serious damage was avoided.

F/O. R. B. G. MURPHY, R.A.A.F., No. 97 Sqn.—F/O. Murphy has flown in operational sorties against targets in many of the very heavily defended towns in Western Germany, Rostock, Gdynia and Genoa. He also took part in the daylight raids on Danzig and Le Creusot.

Photographic Recos.

F/O. D. MURRAY, R.A.F.V.R., No. 26 Sqn.—This officer has displayed the utmost keenness for operational flying, and has taken part in many reconnaissance flights. On two occasions the aircraft in which he was flying has been badly damaged by anti-aircraft fire, but each time owing to his resourcefulness and determination he has successfully flown back to this country. In January, 1943, following his flight commander, F/O. Murray penetrated deep into Northern France, and despite intense fire from the defences, inflicted much damage on enemy transport and caused casualties to German infantry. He has also secured some excellent photographs, taken at low level in the face of heavy fire.

F/O. J. C. PARKER, R.N.Z.A.F., No. 104 Sqn.—This officer has taken part in many operational sorties. On all occasions he has pressed home his attack, often, owing to adverse weather, having to wait for long periods before releasing his bombs.

F/O. R. S. PEARCE, No. 75 (R.N.Z.A.F.) Sqn.—This officer has completed many operational sorties, during which he has performed his duties as wireless operator with unusual skill, which has gained the complete confidence of his crew. He has had a varied operational career, participating in anti-submarine and convoy patrols, and in attacks against some of the enemy's most heavily-defended targets.

F/O. F. RUSKELL, R.A.F.V.R., No. 106 Sqn.—F/O. Ruskell has participated in raids on all the more important and heavily defended enemy targets, and has navigated his aircraft five times to Italy at night. In August, 1942, he accomplished two outstanding mine-laying sorties despite very severe weather, with low cloud, heavy rain and mist. As navigator to the Squadron Commander, this officer took part in the daylight raids on Le Creusot and Milan.

F/O. C. W. STELEY, R.A.A.F., No. 461 (R.A.A.F.) Sqn.—F/O. Steley is a captain of exceptional skill, whose courage and devotion to duty have been an inspiration to his crew. In December, 1942, he sighted and reported an enemy convoy though attacked by three enemy aircraft. He has also taken part in anti-submarine patrols.

F/O. R. A. WELLINGTON, R.A.F.V.R., No. 106 Sqn.—F/O. Wellington has participated in many operational sorties, a large number of which have been against targets in the Ruhr. He has defied the heaviest opposition to bomb his objectives, and on several occasions his aircraft has been damaged. One night in July, 1942, whilst over Wilhelmshaven, his aircraft was heavily engaged by anti-aircraft fire, and later was attacked by an enemy fighter. The bomber sustained severe damage, but F/O. Wellington skilfully flew it back to base.

F/O. J. F. WICKINS, R.A.F.V.R., No. 106 Sqn.—During his operational career this officer has proved himself to be a skilled air gunner. During raids on Rostock, Warnemunde, Genoa, Turin and Berlin he has frequently displayed great resource

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and initiative. He also took part in the daylight raids on Danzig, Le Creusot and Milan, using his guns with good effect against ground targets.

Act. Flt. Lt. F. E. G. YOUSEMAN, R.A.F.V.R., No. 214 Sqn.—This officer has completed a large number of operational sorties against targets in Germany, Italy and enemy-occupied territory. On one occasion he attacked Berlin from 4,000 feet. On another occasion, Flt. Lt. Youseman participated in an attack by night on the Fiat works at Turin. Owing to adverse weather and poor visibility, three runs over the target were necessary before the bombs were released.

Lt. J. C. INGAMELLS, S.A.A.F., No. 24 (S.A.A.F.) Sqn.—Throughout his period of service in the Western Desert, Lt. Ingamells has shown great courage and devotion to duty. As leading observer he has been a valuable member of his squadron.

Lt. J. G. ROSS, S.A.A.F., No. 12 (S.A.A.F.) Sqn.—During recent land operations Lt. Ross was detailed to lay smoke screens for the ground forces by night. He is an excellent pilot, who has led the squadrons on several successful sorties.

Lt. A. E. SISSING, S.A.A.F., No. 12 (S.A.A.F.) Sqn.—Lt. Sissing has taken part in a large number of operational sorties and has led the squadron on several successful raids. His fine example of determination and devotion to duty, both in the air and on the ground, has been an inspiration to others.

P/O. G. W. BRAIN, No. 207 Sqn.—This officer has taken part in a large number of operational sorties. On one occasion, the aircraft in which he was flying was severaly damaged by anti-aircraft fire. Despite this, he successfully navigated it back to this country, where the crew were forced to leave it by parachute. More recently he participated in the daylight raids on Le Creusot and Milan.

F/O. W. H. BRUNSKILL, R.A.F.V.R., No. 51 Sqn.—F/O. Brunskill has participated in a number of bombing sorties and daylight patrols in the Bay of Biscay. He was captain of an aircraft in the Bruneval raid. One one occasion, one engine of his aircraft caught fire and failed, but he flew his aircraft back to this country successfully on one engine for a distance of over 200 miles.

P/O. S. DANAHY, R.C.A.F., No. 57 Sqn.—P/O. Danahy is a keen and dependable captain of aircraft. In October, 1942, he took part in the daylight raid on Milan, an extremely long and difficult operation, during which he displayed resolution and courage in locating the target accurately. In January 1943, after a successful attack on a target in the Ruhr, P/O. Danahy's aircraft was attacked by an enemy night fighter. Though considerable damage was sustained, he skilfully evaded further attacks and flew his bomber safely to base.

Distinguished Flying Medal

Sgt. A. LIDDLE, No. 107 Sqn.—For citation see F/O. Turner.

Flt. Sgt. H. HARWOOD, No. 7 Sqn.—This airman has displayed fine courage and determination throughout many operational sorties against heavily defended and distant targets. Excellent photographs of the target area have borne witness to his skill when bombing.

Flt Sgt. H. HEADINGS, No. 12 Sqn.—Flt. Sgt. Headings has completed a large number of operational sorties. Th oughout he has always shown the greatest keenness to engage the enemy whilst his skill in navigation has been of the highest order.

Flt. Sgt. R. J. HORTON, A.A.F., No. 102 Sqn.—Flt. Sgt. Horton has displayed great coolness and courage in action over enemy territory on many occasions. He is an air gunner of outstanding merit who has been particularly successful against night fighters.

Flt. Sgt. A. IRELAND, No. 83 Sqn.—This airman has completed a large number of operational sorties, several of which have been of a particularly daring character. These include the "1,000" raid on Bremen and a daylight attack on the submarine yards at Danzig made from under very low clouds. During a hazardous daylight attack on a target in the Ruhr, Flt. Sgt. Ireland's aircraft was badly damaged by anti-aircraft fire and afterwards attacked by four enemy fighters. Operating as mid-upper gunner, he counter-attacked with great skill and probably saved his aircraft from being shot down.

Turret Repaired

Flt. Sgt. H. E. A. KNOX, R.A.A.F., No. 460 (R.A.A.F.) Sqn.—Flt. Sgt. Knox has displayed consistent skill and courage. On one occasion, whilst on the outward journey to Turin, his turret became unserviceable. At a height of approximately 12,000 feet this airman effected most difficult repairs thereby rendering his turret serviceable again. This N.C.O.'s enthusiasm for operational flying is equalled only by his technical efficiency and devotion to duty.

Flt. Sgt. F. C. KRUGER, R.C.A.F., No. 97 Sqn.—Flt. Sgt. Kruger has taken part in many sorties against targets in Germany and Italy, including the daylight raid on Milan. One night in November, 1942, when on an outward flight to Turin, he found the aileron controls were not working satisfactorily. Nevertheless, displaying great skill, Flt. Sgt. Kruger succeeded in flying over the Alps and proceeded to the target. During the run up the aircraft was hit by anti-aircraft fire, but this airman pressed home his attack and afterwards flew safely back to base.

Flt. Sgt. H. LAVET, No. 83 Sqn.—This airman has displayed exceptional keenness and efficiency despite many hazardous experiences. He took part in the daylight attack on Danzig, during which he did excellent work in attacking searchlights and gun positions. Shortly afterwards in the course of a sortie against a target in the Ruhr both over the target and when his aircraft was attacked by two enemy fighters, Flt. Sgt. Lavey directed evasive action and counter-attacked with great coolness and courage. Subsequently this airman took part in attacks on shipping in the Elbe estuary and a low-level moonlight attack on Stuttgart.

Flt. Sgt. P. E. MCCARTHY, R.A.A.F., No. 61 Sqn.—Flt. Sgt. McCarthy took part in the daylight raids on Le Creusot and Milan and achieved excellent results. As a bomb aimer he has displayed skill and initiative.

Flt. Sgt. S. R. D. MCGRORY, R.A.A.F., No. 460 (R.A.A.F.) Sqn.—Flt. Sgt McGrory has completed a number of operational sorties which have been marked by a keenness, determination and cheerful devotion to duty worthy of the highest praise. One night in January, 1943, when engaged in an attack against Berlin he made two runs over the target to ensure accuracy of his bomb aiming.

Flt. Sgt. J. A. MARSHALL, No. 115 Sqn.—Flt. Sgt. Marshall has completed many operational sorties. His missions have included attacks on many heavily defended objectives in Germany and Italy.

Flt. Sgt. P. J. MUSK, No. 83 Sqn.—On one occasion, when attacking Cologne, Flt. Sgt. Musk's aircraft was very heavily engaged and damaged by anti-aircraft fire and forced almost to ground level. Despite this, the target was accurately bombed. This wireless operator has displayed unusual technical skill and has frequently given his captain valuable assistance in avoiding ground defences.

Flt. Sgt. G. NEWALL, No. 207 Sqn.—Flt. Sgt. Newall has taken part in a large number of operational sorties. Twice when flying in Hampden aircraft with only one engine functioning, he has rendered skilful assistance which contributed to the safe return of the aircraft. On one occasion, when on a mine-laying operation, he shot out several searchlights, and another time he attacked an enemy convoy with machine guns.

Flt. Sgt. E. G. POINTER, No. 7 Sqn.—Flt. Sgt. Pointer has taken part in a large number of operational sorties in heavy bomber aircraft. He is a most valuable member of air crew who by his efficiency and unceasing efforts has set a very high standard.

Flt. Sgt. G. ROBINSON, No. 1 Sqn.—Flt. Sgt. Robinson has flown in many operational sorties against distant objectives and well-defended targets in Germany. He has always performed his duties as flight engineer in a most efficient manner.

Flt. Sgt. E. E. RUTLEDGE, R.C.A.F., No. 69 Sqn.—During the last four months Flt. Sgt. Rutledge has been operating from Malta with outstanding enthusiasm and skill. He has set an example to the flight which has been of inestimable value to his Squadron Commander.

Flt. Sgt. A. B. SMART, No. 83 Sqn.—This airman has flown on a large number of operational sorties. His exceptional technical knowledge has proved invaluable, and on two occasions he has effected repairs while in the air, thus enabling his captain to land the aircraft safely.

Consistent Accuracy

Flt. Sgt. J. K. RIDLEY, R.A.A.F., No. 83 Sqn.—This airman has displayed a very high standard of navigational skill while flying on operational missions. His consistent accuracy has invariably enabled his crew to arrive at the objective at the right moment. On one sortie against Hamburg, the entire journey to and from the target was completed on three engines, and in spite of the consequent difficulties, Flt. Sgt. Ridley efficiently and calmly navigated the aircraft and assisted in accomplishing a highly successful mission.

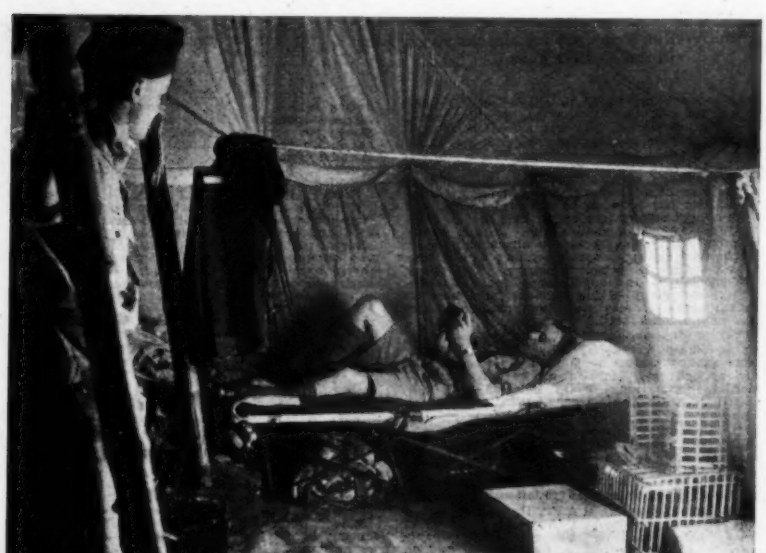
Flt. Sgt. C. SMITH, No. 97 Sqn.—Flt. Sgt. Smith has participated in many successful sorties against German and Italian targets, including the daylight raids on Le Creusot and Milan. His captaincy has been of a high order.

Flt. Sgt. V. R. STEPHENS, R.A.A.F., No. 97 Sqn.—This airman is a very competent and courageous captain of aircraft. His operations have included attacks on such targets as Berlin, Turin and Genoa, and he participated in the daylight raids on Le Creusot and Milan. After releasing his bombs, he has frequently made successful reconnaissances in the target area.

Flt. Sgt. A. W. STEWART, R.C.A.F., No. 101 Sqn.—Throughout his operational career, Flt. Sgt. Stewart has displayed coolness and presence of mind in emergency. One night in August, 1942, when his aircraft was severely damaged by night fighters, he rendered first aid to the wounded navigator and rear gunner, and later when the aircraft had to descend on the sea, his initiative considerably aided the eventual rescue of these two wounded members of the crew.

Flt. Sgt. A. TEMM, R.N.Z.A.F., No. 104 Sqn.—Flt. Sgt. Temm has taken part in many operational sorties. On several occasions his skill as wireless operator has been instrumental in the success achieved. He has always been ready to advise and help less experienced wireless operators.

Flt. Sgt. R. L. WEATHERALL, R.C.A.F., No. 207 Sqn.—On all his operational sorties Flt. Sgt. Weatherall has displayed a fine fighting spirit and determination to engage the enemy. Twice his aircraft has been attacked by fighters at night. On the first occasion, three enemy fighters attacked, but Flt. Sgt. Weatherall replied with such effective bursts of fire that all three enemy aircraft broke away and did not resume the attack. On the second occasion, when his aircraft was attacked by a Me 110, he succeeded in driving it away.



MIDDLE EAST EASE : Officers' quarters in tropical double-roofed tents. Tangerine baskets and bomb cases make up most of the utility furniture.

Roll of Honour

Casualty Communiqué No. 220.

THE Air Ministry regrets to announce the following casualties on various dates. The next of kin have been informed. Casualties "in action" are due to flying operations against the enemy; "on active service" includes ground casualties due to enemy action, non-operational flying casualties, fatal accidents and natural deaths.

Of the names in this list 22 are second entries giving later information of casualties published in earlier lists.

Royal Air Force

KILLED IN ACTION.—Sgt. R. Clare; F/O. E. Doyle; Sgt. W. E. C. Heath; Sgt. D. Howarth; Sgt. G. C. Major; Flt. Lt. E. B. Mortimer-Rose, D.F.C.; Sgt. G. C. Phillips; Sgt. W. Simpson; P/O. P. J. N. Stancliffe; Sgt. R. J. Tasker.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Flt. Sgt. R. T. Adams; Sgt. R. A. Attwater; Sgt. W. P. Beare; Sgt. R. Ellis; Sgt. N. Fountain; Sgt. W. T. G. Hall; Sgt. W. H. Leedham; Sgt. J. Leonard; Sgt. R. G. Miller; Sgt. R. Parker; Sgt. N. A. Penstone; Sgt A. Simpson; Sgt. N. R. Wiltcher.

PREVIOUSLY REPORTED MISSING, NOW REPORTED KILLED IN ACTION.—Flt. Sgt. S. A. Conibear; P/O. J. E. Hope; P/O. G. T. Thomson; Sgt. J. E. Watson.

WOUNDED OR INJURED IN ACTION.—F/O. P. T. Muirhead.

DIED OF WOUNDS OR INJURIES RECEIVED IN ACTION.—Sgt. T. Frith.

MISSING, BELIEVED KILLED IN ACTION.—F/O. G. R. Baker; Sgt. J. H. Brooks; Act. Flt. Lt. W. T. Christie, D.F.M.; Sgt. J. A. Daragon; Sgt. E. Hartley; Sgt. A. E. Holland; Sgt. J. M. Illiff; Sgt. J. Kirby; Sgt. R. B. MacWilliam; Sgt. C. M. Page; Sgt. R. Shaw; Sgt. R. W. Shearon.

MISSING.—Sgt. C. F. Abraham; F/O. D. A. Allen; Sgt. R. Allan; Sgt. L. F. Axby; Sgt. R. V. Baker; Sgt. E. S. Bala; Sgt. G. L. Banks; Sgt. H. A. Bastick; Sgt. J. H. A. Beath; P/O. J. D. Birch; Sgt. A. L. Bond; P/O. P. D. O'D. Carey; Sgt. L. W. Clubley; Sgt. J. Collingridge; W/O. J. A. Cook; Sgt. D. V. Corrigan; Flt. Sgt. W. H. Cowman; Sgt. R. H. Credland; Sgt. J. H. Curry; Sgt. J. H. Curtis; Sqn. Ldr. D. F. W. Darling, D.F.C.; Sgt. H. Dennis; Sgt. L. C. Ehrhart; Sgt. A. J. Ellis; Sgt. E. J. Forward; Sgt. R. F. Fowler; Sgt. A. D. D. Gee; P/O. A. E. Gough; Sgt. J. H. Halliwell; F/O. R. C. Hill; Sgt. J. Hillhouse; F/O. R. C. Hogg; Sgt. A. Holt; F/O. D. J. Hopson; P/O. P. T. Howson; Sgt. W. Jackson; Sgt. C. W. James; Sgt. R. A. Johnston; Sgt. K. S. Keeble; Sgt. K. W. Keen; Sgt. A. E. Keeton; Act. Flt. Lt. R. L. Knowles; Sgt. G. C. Lake; Sgt. G. C. Layley; F/O. R. G. Lewis; Sgt. A. M. Limbrick; Sgt. H. J. Long; Sgt. G. J. McConnachie; P/O. E. McDonald; Sgt. W. H. Macklin; Sgt. N. J. Madgett; Sgt. E. Mannering; P/O. K. L. Morgan; Sgt. M. J. Norgate; Sgt. A. R. Parker; Sgt. C. G. Parr; F/O. S. Pearson; Sgt. D. C. Pennycook; Sgt. C. G. Phillips; Sgt. D. H. Powell; Act. Flt. Lt. K. Powell; Sgt. E. J. Ramm; F/O. E. L. G. Ratcliffe; Sgt. D. Robinson; F/O. J. D. Robertson; Flt. Sgt. R. J. Rogers; F/O. A. J. Ross; Sgt. R. C. Rost; Sgt. R. J. P. Salt; Sgt. F. Saunders; P/O. A. R. Shepherd; Sgt. L. W. Simkiss; F/O. R. H. Stent; Sgt. J. L. Surtees; F/O. J. C. Taffs; P/O. K. A. Taylor; Sgt. L. M. Thomas; Sgt. C. Thorpe; Sgt. J. A. Wade; P/O. T. G. Watson; Sgt. R. G. Weaver; Sgt. N. Whitehead; Sgt. H. L. Williams; F/O. J. Williams; Sgt. R. Williams; P/O. C. K. Wood; F/O. W. Wright; Sgt. A. R. York; Sgt. G. E. Young.

KILLED ON ACTIVE SERVICE.—Sgt. W. J. Adams; P/O. T. H. Anthony; Sgt. L. S. Aslin; Sgt. G. W. Ayres; Sgt. S. C. Bradley; F/O. E. J. Butler; Sgt. T. Butterley; Sgt. E. W. Campbell; Cpl. D. H. Chard; L.A/C. T. D. Colquhoun; Sgt. E. N. Common; Sgt. W. R. Deacon; A/C.1 J. Dodsworth; Sgt. P. E. Farren; Sgt. H. H. Gleadhall; P/O. A. S. N. Gould; Sgt. R. Hooper; P/O. S. E. Lambert; Sgt. P. A. Morgan; P/O. A. J. F. Mortimer; L.A/C. J. W. F. Newcombe; L.A/C. A. Newsham; P/O. W. P. G. O'Brien; Sgt. F. C. W. Palmer; A/C.1 J. H. Pedrick; Cpl. J. R. S. Philip; F/O. R. H. G. Phillips; Sgt. A. Priest; L.A/C. F. Quinn; Sgt. R. P. Thomson; Act. Flt. Lt. J. E. Van Schaick; F/O. J. G. Ward; Sgt. R. B. Wetherell; Sgt. W. H. Wood.

PREVIOUSLY REPORTED MISSING, NOW REPORTED KILLED ON ACTIVE SERVICE.—P/O. J. Bluck.

WOUNDED OR INJURED ON ACTIVE SERVICE.—L.A/C. W. J. Allen; L.A/C. C. H. F. Anthony; L.A/C. M. J. Armer; Sgt. R. R. Clarke; Sgt. N. Cumber; L.A/C. R. Gale; L.A/C. J. W. Lloyd; Flt. Sgt. L. J. Palmer; Sgt. G. A. Reynolds; L.A/C. J. A. Shaw; L.A/C. K. J. Smart; A/C.1 K. H. Squires; L.A/C. E. A. Whitely.

DIED OF WOUNDS OR INJURIES RECEIVED ON ACTIVE SERVICE.—Sgt. J. H. Dyer; Sgt. W. L. James.

DIED ON ACTIVE SERVICE.—Cpl. R. B. Benson; Cpl. R. W. Bliss; A/C.2 F. T. Hanlon; L.A/C. A. S. Pirie; Act. Group Capt. F. G. Sherriff, O.B.E., M.C.; A/C.2 K. H. Shotter.

Royal Australian Air Force

KILLED IN ACTION.—Sgt. R. J. Jabour; Sgt. E. G. Palmer.

PREVIOUSLY REPORTED MISSING, NOW REPORTED KILLED IN ACTION.—Sgt. A. MacLean; Sgt. T. F. B. McKenna.

MISSING, BELIEVED KILLED IN ACTION.—P/O. W. G. Diehm; Sgt. L. J. Hammond.

MISSING.—Sgt. A. H. Borrett; Flt. Sgt. R. A. Brittingham; Sgt. I. G. Brodie; P/O. D. S. Cormack; P/O. E. S. Hayes; P/O. S. J. James; P/O. P. Kingsford-Smith; Sgt. A. H. Martin; Flt. Sgt. W. M. J. Matchett; Sgt. J. E. Parkes; Sgt. N. H. Simpson; Sgt. G. B. Sullivan; Flt. Sgt. J. K. Swain; Flt. Lt. R. J. Watt; Sgt. C. J. J. Wellesley; Sgt. T. H. Williams.

KILLED ON ACTIVE SERVICE.—Sgt. P. Blanch; P/O. F. T. Britten; Sgt. W. A. Catron; Flt. Sgt. F. L. Hicks; Sgt. K. B. Killeen.

WOUNDED OR INJURED ON ACTIVE SERVICE.—Sgt. N. C. Craigie; P/O. N. G. Traylen.

Royal Canadian Air Force

KILLED IN ACTION.—Sgt. W. A. Johnson.

PREVIOUSLY REPORTED MISSING, NOW REPORTED KILLED IN ACTION.—Flt. Sgt. H. F. Thompson.

MISSING, BELIEVED KILLED IN ACTION.—Sgt. F. H. Barrett; W/O. L. O'N. Weakley.

MISSING.—Sgt. H. G. Black; Sgt. D. M. Brackenbridge; F/O. L. B. Carson; Flt. Sgt. A. L. Cross; Flt. Sgt. F. A. Dawkins; Sgt. R. W. Drury; Sgt. C. P. Garvey; Sgt. J. E. R. Gigueree; Sgt. L. A. J. Latour; Sgt. R. C. Legge; Sgt. H. D. Lewis; F/O. C. R. Long; Sgt. W. H. Lough; F/O. J. W. Millar; Flt. Sgt. K. M. Perkins; Flt. Sgt. J. F. Sayers; Sgt. W. W. Scrimgeour; Flt. Sgt. D. W. Smith; P/O. J. T. Wills; Sgt. W. W. Wilson.

KILLED ON ACTIVE SERVICE.—Sgt. C. E. Caldwell; Sgt. R. A. Chapman; Sgt. R. C. Collins; Sgt. R. R. Hill; Flt. Sgt. J. W. McCausland; Sgt. A. A. Mitchell.

DIED ON ACTIVE SERVICE.—L.A/C. J. C. Milner.

Royal New Zealand Air Force

MISSING, BELIEVED KILLED IN ACTION.—Sgt. G. B. Marsh.

MISSING.—Sgt. A. J. D. Barton; Sgt. M. W. Bentley; F/O. B. V. Crawford; Sgt. D. Durham; Sgt. P. D. Freeman; Sgt. N. Hunter; Sgt. R. E. Redding.

KILLED ON ACTIVE SERVICE.—Sgt. L. F. Croker; Sgt. T. Lindley; Sgt. A. McNae.

South African Air Force

PREVIOUSLY REPORTED MISSING, NOW REPORTED KILLED IN ACTION.—Lt. L. M. Marshall.

WOUNDED OR INJURED IN ACTION.—Lt. Jemimrock; Capt. E. J. Lever.

MISSING.—Lt. G. W. Booysen.

KILLED ON ACTIVE SERVICE.—Lt. G. M. Hetherington.

WOUNDED OR INJURED ON ACTIVE SERVICE.—Lt. G. T. Van Rooyen.

Casualty Communique No. 221

Of the names in this list 54 are second entries giving later information of casualties published in earlier lists.

Royal Air Force

KILLED IN ACTION.—P/O. C. O. Bodding; Sgt. E. A. Brown; F/O. F. J. Brown; Sgt. A. W. Butcher; Sgt. L. J. Corfield; F/O. E. R. Cowan; Flt. Sgt. G. W. Dixon; Sgt. G. F. Done; Sgt. J. R. Elding; Sgt. W. H. Gladwell; Flt. Sgt. H. G. Hancorn; Sgt. J. G. Innes; Sgt. H. S. Jones; Act. Flt. Lt. H. O. Knowles; P/O. H. L. B. Lewis; Sgt. J. H. Manning; Sgt. W. G. Murton; P/O. D. J. Owen; Flt. Lt. D. J. Passadoro; Act. Sqn. Ldr. R. J. Peacock, D.F.C.; F/O. A. M. Peake; Sgt. K. Roderick; Sgt. T. C. Toy; Sgt. A. A. F. Williams.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—P/O. J. D. Baxter, D.F.M.; P/O. A. V. Brooks; Act. Wing Cdr. L. V. James, D.F.C.; Sgt. H. E. Jones.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Sgt. W. E. Ackerman; Sgt. T. J. Bacon; Sgt. J. E. Baillie; F/O. D. L. R. Bee; Sgt. R. F. Birchnall; Sgt. W. C. Brodie; Sgt. J. Brown; Sgt. H. F. P. Clark; P/O. P. C. Coulthard; F/O. J. A. Esler; Sgt. K. A. Evans; Sgt. G. P. Forster; Sgt. H. C. Knipe; Sgt. R. H. Lewen; Flt. Sgt. R. A. Linford; P/O. E. P. McDevitt; Sgt. A. D. Meech; Flt. Sgt. S. R. Moore; Sgt. A. Mounteney; Sgt. V. F. Munt; Flt. Sgt. H. J. R. Nash; Flt. Sgt. D. A. Neave; Sgt. H. Newey; Flt. Sgt. L. O'Hara; Sgt. R. M. Scott; Sgt. A. G. Strickland; Sgt. L. G. L. Ward; Sgt. P. H. White.

PREVIOUSLY REPORTED MISSING, NOW REPORTED KILLED IN ACTION.—P/O. F. Franklin.

DIED OF WOUNDS OR INJURIES RECEIVED IN ACTION.—Sgt. E. J. P. Bergna; Sgt. G. P. Pollard.

MISSING, BELIEVED KILLED IN ACTION.—Sgt. A. M. Templeton.

MISSING.—Sgt. J. C. Adam; Sgt. J. Allan; Sgt. F. F. Allen; Sgt. J. H. Bousefield; Sgt. J. Brown; P/O. F. Buchanan; Sgt. D. J. W. Butlery; Sgt. C. S. Carroll; Sqn. Ldr. W. Clarke; Sgt. D. O. C. Culshaw; F/O. F. A. Davies; Sgt. H. F. Davies; P/O. D. G. De Garis; Sgt. J. H. P. Evans; Sgt. R. F. Evans; Sgt. J. G. Faux; Act. Sqn. Ldr. W. Fletcher, D.F.C.; Sgt. L. Fox; Sgt. J. E. Francis; P/O. W. J. Hart; Sgt. W. J. Higgs; Sgt. F. C. Howe; Sgt. G. E. Johnson; Sgt. H. Kay; Sgt. R. Martin; Sgt. J. H. Maudson; Sgt. C. Milburn; P/O. G. H. Miller, D.F.M.; F/O. J. M. Myers; Act. Flt. Lt. P. J. Nankivell; F/O. C. M. Parsons; Sgt. T. Patterson; Sgt. E. E. Paul; Flt. Lt. H. A. J. Pierre; Sgt. S. T. Pellard; Sgt. P. Sandover; P/O. D. H. Smith; Sgt. R. B. Smith; Sgt. R. Stansfield; Sgt. C. Stubbs; Sgt. G. Templeton; Sgt. P. R. Trevayne; Sqn. Ldr. P. R. M. Van der Heijden; Flt. Sgt. V. R. Wood; Sgt. D. C. Young.

KILLED ON ACTIVE SERVICE.—Sgt. R. J. Bennett; Sgt. C. J. Berwick; Sgt. J. Blunden; L.A/C. J. B. Burd; Sgt. C. Clarke; Sgt. N. S. Deveraux-Mack; Flt. Sgt. L. M. Fleming; Sgt. H. Hewitt; Sgt. H. E. Hole; P/O. S. Hoy; Sgt. T. H. Jackson; Sgt. D. F. E. Jenner; F/O. S. R. Jones; P/O. F. M. Krish; L.A/C. W. H. Lloyd; Sgt. W. A. Marwood; Sgt. S. J. Meddings; Sgt. A. W. Peach; Sgt. W. T. Raeside; L.A/C. F. R. Redfern; L.A/C. E. Smith; L.A/C. C. J. Street; Flt. Sgt. P. Tanner; Sgt. G. B. Tarran; Sgt. J. Westwood; L.A/C. K. D. G. J. Wilson.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED ON ACTIVE SERVICE, NOW PRESUMED KILLED ON ACTIVE SERVICE.—L.A/C. H. Allen; Sgt. G. Hardy; A/C.2 D. D. Lindsay.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED ON ACTIVE SERVICE, NOW REPORTED KILLED ON ACTIVE SERVICE.—Flt. Sgt. A. C. Alberry; Flt. Sgt. G. B. Hardman.

WOUNDED OR INJURED ON ACTIVE SERVICE.—F/O. H. V. D. Bonney; L.A/C. J. A. H. Chambers; P/O. A. W. Kilpatrick; Sgt. J. T. Wallace.

DIED OF WOUNDS OR INJURIES RECEIVED ON ACTIVE SERVICE.—F/O. K. C. R. Maskell; Sgt. W. E. Tanner.

DIED ON ACTIVE SERVICE.—L.A/C. G. Armstrong; A/C.2 R. F. Bonnick; A/C.2 G. E. Brown; A/C.1 E. G. Carpenter; A/C.1 W. W. J. Clamp; A/C.2 J. Crane; Flt. Sgt. F. Crighton; A/C.2 L. J. S. Delves; L.A/C. W. G. Dodds; A/C.1 F. Ellis; A/C.2 A. P. Epps; L.A/C. G. W. Ford; L.A/C. R. E. Grainger; A/C.1 A. M. Higham; L.A/C. A. R. Langston; L.A/C. S. J. Peckett; Sgt. J. Piggott; L.A/C. S. Smith; L.A/C. R. H. Stevenson; Cpl. K. Webster; A/C.2 W. Wood.

PREVIOUSLY REPORTED MISSING, NOW REPORTED PRISONER OF WAR.—Sgt. G. Bennet; Sgt. E. L. Bradshaw; Sgt. E. B. Doublard; Sgt. A. Ford; Sgt. J. B. Shone; Flt. Sgt. J. B. Woodman; Sgt. J. T. Worrall.

Women's Auxiliary Air Force

DIED ON ACTIVE SERVICE.—A/CW.1 M. B. Burge.

Royal Australian Air Force

KILLED IN ACTION.—W/O. A. G. Eddy; Flt. Sgt. B. M. Ferguson; Flt. Sgt. D. J. Lock; Sgt. J. H. Stevenson.

WOUNDED OR INJURED IN ACTION.—Sgt. C. O. Hunter.

MISSING, BELIEVED KILLED ON ACTIVE SERVICE.—Sgt. W. R. G. Anderson; Sgt. L. Gill.

KILLED ON ACTIVE SERVICE.—P/O. M. A. Mc Rae; Sgt. J. C. Sharpley; Flt. Sgt. D. P. Wayne.

An open-air class for R.A.F. apprentices. The subject matter is a Merlin-engined Beaufighter Mk. II.

SERVICE AVIATION

WOUNDED OR INJURED ON ACTIVE SERVICE.—Sgt. M. G. Smith.

DIED ON ACTIVE SERVICE.—Act. Flt. Lt. J. H. Kearns.

Royal Canadian Air Force

KILLED IN ACTION.—Sgt. McK. Allen; Sgt. J. D. Bittner; Sgt. P. E. E. Brown; Flt. Sgt. C. M. Downton; Flt. Sgt. L. H. Gleason; F/O. M. McA. Kempton; Flt. Sgt. F. G. Nelson; Sgt. D. R. Sanderson; Flt. Sgt. H. H. Sealy; Sgt. H. E. Stanley.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—Flt. Sgt. A. D. Adair; Flt. Sgt. J. F. Haley.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Flt. Sgt. G. F. Alger; Flt. Sgt. I. L. Charbonneau; Sgt. M. Knight; Flt. Sgt. J. A. Long; Sgt. G. F. MacNutt; Flt. Sgt. G. A. Tooth.

WOUNDED OR INJURED IN ACTION.—Sgt. G. E. Beauchamp; Sgt. H. R. Ernst.

MISSING, BELIEVED KILLED IN ACTION.—F/O. J. I. MacKenzie; Flt. Sgt. D. O'Neill; Sgt. A. H. Thiessen.

MISSING.—Flt. Sgt. J. N. Barry; P/O. O. R. Brown; Sgt. R. B. Carlson; F/O. G. H. F. Carter; Sgt. W. P. Duthie; F/O. W. J. Freeman; Sgt. L. A. Gonnet; Sgt. R. M. Hill; Flt. Sgt. H. W. Laughlan; Flt. Sgt. J. Lawrence; Flt. Sgt. J. F. MacDonald; P/O. J. D. MacKenzie; Flt. Sgt. W. McK. Murdoch; Flt. Sgt. W. O. Powell; F/O. J. C. Thomas; Sgt. J. E. R. Turenne; F/O. R. J. Turp.

KILLED ON ACTIVE SERVICE.—P/O. S. H. Amys; Sgt. R. C. H. Boulton; Sgt. A. V. McD. Buckingham; Sgt. R. F. Cairns; Sgt. J. G. Campbell; Flt. Sgt. L. S. Carpenter; Sgt. M. A. Dixon; Sgt. W. J. Hackett; P/O. M. S. Jacobs; Sgt. G. W. Kennedy; Sgt. R. Kennedy; Sgt. J. D. Kester; W/O. G. A. Molozzi; Sgt. H. O. B. Payne; Sgt. B. E. Wilkinson.

DIED OF WOUNDS OR INJURIES RECEIVED ON ACTIVE SERVICE.—F/O. A. E. David.

Royal New Zealand Air Force

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Sgt. J. N. McConnell.

MISSING.—Sgt. R. F. Connor; P/O. J. McCullough; Sgt. T. A. Murphy; P/O. H. R. Parker; F/O. S. A. H. Short.

South African Air Force

KILLED ON ACTIVE SERVICE.—Flt. Sgt. J. B. A. Bowen; 2/Lt. R. P. D. McNeil; Air Sgt. D. R. Phillips; Lt. M. W. Turner; Lt. P. E. Van Reusburg; 2/Lt. G. J. Van Vuuren; Lt. W. E. Wylie.

Indian Air Force

KILLED ON ACTIVE SERVICE.—P/O. Singh Kartar.

WOUNDED OR INJURED ON ACTIVE SERVICE.—Sgt. S. K. Ghose.

DIED ON ACTIVE SERVICE.—Enr. Flwr. Mundswamy.

Casualty Communiqué No. 222

Of the names on this list 49 are second entries giving later information of casualties published in earlier lists.

Royal Air Force

KILLED IN ACTION.—Sgt. T. B. Barfoot; Sgt. G. M. Bown; Flt. Sgt. C. H. Bray; Sgt. G. A. Brind; F/O. J. A. Clandillon; Sgt. J. Dudley; Sgt. R. Fox; Sgt. J. A. Garland; Sgt. L. V. Herbert; Sgt. D. Livingston; Sgt. G. Robinson; Sgt. J. J. Robson; Sgt. R. C. Rosam; Sgt. W. B. H. Smalley; Sgt. C. J. D. Smith; Sgt. D. M. Turton; Sgt. E. L. Widgery.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—Sgt. P. R. Abbas; Sgt. R. A. Archer; Sgt. W. Archer; Sgt. R. Armstrong; Flt. Sgt. J. R. St. G. Arrowsmith; P/O. D. C. August; Flt. Sgt. F. F. Barker, D.F.M.; Sgt. D. P. Brooks; Flt. Sgt. E. J. Ford, D.F.M.; Sgt. R. Greenwood; Sgt. W. G. Harrison; Flt. Sgt. C. R. Metcalfe; Flt. Sgt. J. W. Stell; Flt. Sgt. J. Thompson.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Sgt. W. H. Arnold; P/O. F. H. A. Ashford; Sgt. B. S. Brown; Sgt. A. D. Gardiner; P/O. A. De F. Gardner; Sgt. G. Glassbrook; Sgt. F. J. L. Hanson; P/O. L. J. Harcus; Flt. Sgt. S. V. Harding; Sgt. R. E. Hart; Sgt. W. F. Morgan; Sgt. G. K. M. Newman; Sgt. G. T. Owen; Sgt. D. Pearson; Sgt. S. W. Precious; Sgt. W. Simons; Sgt. I. B. H. Spooner; Flt. Sgt. J. L. Tarran; Sgt. H. F. V. Wheway; Sgt. F. T. Williams.

A Hurricane IIc guiding a North African Air/Sea Rescue launch to the stranded aircrew.

PREVIOUSLY REPORTED MISSING, NOW REPORTED KILLED IN ACTION.—P/O. J. Grant, D.F.C.; Wing Cdr. H. G. Malcolm; F/O. J. Robb.

WOUNDED OR INJURED IN ACTION.—Sgt. B. D. Hall; Sgt. J. F. London; Sgt. S. G. Willcocks.

MISSING, BELIEVED KILLED IN ACTION.—Sgt. W. E. Baker; Sgt. N. B. Johnstone; P/O. G. R. Powell.

MISSING.—Sgt. A. S. Aitchison; Sgt. F. J. Allen; P/O. W. A. McL. Archibald; Sgt. E. Atkins; W/O. J. H. Bailey; Flt. Sgt. M. E. Barker; F/O. R. L. Barnet; Flt. Sgt. J. Bartley; Flt. Lt. N. L. Baugh, M.C.; Flt. Sgt. S. Baxter; Sgt. D. R. Bishop; Sgt. A. E. Booth; L.A/C. R. D. Bond; Sgt. F. J. Bray; Flt. Sgt. H. A. Brindle; A/C.2 W. G. C. Brown; P/O. A. J. Burton; Sgt. D. G. Busby; Sgt. T. A. Butt; Sgt. S. R. Cann; Sgt. D. E. Cardwell; Sgt. G. Cave; Flt. Lt. O. C. Chave; Sgt. J. F. Christon; Sgt. J. F. Cook; Sgt. R. E. Cooke; Sgt. T. Cosford; Sgt. E. Couldwell; Sgt. W. G. Creed; Act. Flt. Lt. E. A. Davies; Cpl. K. Davies; P/O. G. K. Dearden; Act. Flt. Lt. W. Docherty; Sgt. J. W. T. Dufficld; F/O. A. F. J. Duncan; Sgt. L. F. Eastoe; Sgt. J. E. Edmeades; Cpl. W. R. Essex; Sgt. K. Firth; Sgt. H. C. Ford; Sgt. L. A. France; Sgt. C. C. Greenaway; F/O. E. I. Griffiths; Sgt. W. G. Harris; Sgt. J. Harrison; Sgt. E. J. R. Hart; Sgt. F. W. Heaton; F/O. M. J. Horsey; Sgt. D. W. Howard; Cpl. H. S. Hyslop; Sgt. G. H. James; Sgt. L. E. James; P/O. C. G. Jones; Sgt. N. Jones; Cpl. L. A. Kearsley; Sgt. J. Kennedy; Flt. Sgt. H. J. Knight; L.A/C. G. B. Lamb; Sgt. J. B. Lewis; Sgt. K. Loach; Flt. Sgt. A. A. MacKenzie; Sgt. D. McNeill; Sgt. F. McNeil; F/O. R. Martin-Trigona; Flt. Sgt. A. J. C. Mason; P/O. E. D. Markham; Sgt. R. Moorin; P/O. J. M. MacM. Muir; Sgt. W. R. Neville; Sgt. J. E. Nicholls; Sgt. J. O. Nicholls; F/O. C. E. Nicholson; Sgt. J. G. J. Nolan; Sgt. P. T. C. Oldham; Sgt. T. Penrose; Sgt. E. N. Perkins; Sgt. M. A. Pollard; P/O. F. S. Potter; Sgn. Ldr. W. H. Powdrell; Sgt. P. N. Reed; Sgt. E. A. Rolfe; Sgt. G. R. W. Ross; Flt. Sgt. H. Rowson; Sgt. C. S. Rumble; Sgt. A. G. Rusling; Sgt. J. Sankey; Sgt. A. A. Self; Sgt. W. J. Semple; Sgt. R. Shears; Sgt. A. Simmons; Sgt. W. Smith; Sgt. K. Spooner; Sgt. H. R. Stevenson; Sgt. R. M. Stevenson; F/O. M. J. Steward; Sgt. T. F. Stocks; Sgt. W. A. Summerson; Sgt. A. W. Thomas; Flt. Lt. W. J. H. Tucker; Sgt. K. W. Valentine; L.A/C. B. Weighell; Sgt. F. Whitwell; P/O. R. A. Williams; A/C.1 T. G. Williamson; Flt. Sgt. J. Wood; Sgt. J. C. Woodward; P/O. D. Young.

KILLED ON ACTIVE SERVICE.—Sgt. J. Andrew; Sgt. S. Bellis; Sgt. W. Billingham; Sgt. E. Brook; Sgt. D. Campbell; Sgt. F. W. Gurney; Sgt. P. D. King; Sgt. S. O. Koster; Sgt. J. J. McGrohan; Sgt. D. Marsden; Sgt. A. D. Marsden; Flt. Sgt. A. R. Smith; Cpl. A. W. Talbot; P/O. A. D. Walford; Act. Flt. Lt. M. N. Waugh.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED ON ACTIVE SERVICE.—Sgt. L. J. Grove; Sgt. W. Hurley.

WOUNDED OR INJURED ON ACTIVE SERVICE.—A/C.2 J. E. T. Adkins; Sgt. L. Airey; Flt. Sgt. G. F. Dove.

DIED ON ACTIVE SERVICE.—A/C.2 W. Hallworth; A/C.1 S. G. H. Lewis; L.A/C. H. P. McCabe; L.A/C. A. Nixon; Cpl. M. H. Smith.

Women's Auxiliary Air Force

DIED ON ACTIVE SERVICE.—A/CW.2 B. T. Hasprey.

Royal Australian Air Force

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—Sgt. B. G. P. Balleine; F/O. T. H. Bourke; Sgt. R. P. Davis; Act. F/O. W. M. Murphy.

WOUNDED OR INJURED IN ACTION.—Flt. Sgt. W. R. Martin.

MISSING.—P/O. H. J. M. Campbell; Flt. Sgt. A. R. Grainger; Sgt. D. Hood; Flt. Sgt. R. E. H. Hope; Sgt. J. H. McCarthy; Sgt. K. R. Phelps; Sgt. A. W. Stubbs; Sgt. J. I. Thompson; Flt. Sgt. C. C. Truman; Sgt. J. C. H. Young.

KILLED ON ACTIVE SERVICE.—Cpl. G. R. Kanake; Sgt. L. J. Reid; P/O. J. M. Whitehead.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED ON ACTIVE SERVICE.—Sgt. E. A. Bailey.

Royal Canadian Air Force

KILLED IN ACTION.—Sgt. R. E. Allin; Flt. Sgt. L. A. Cummings; Sgt. N. E. Holness; Sgt. M. S. Napier; Sgt. I. L. Sanitsky; Sgt. J. W. Warner.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—P/O. J. D. N. Bain; Flt. Sgt. W. T. Cormack; Flt. Sgt. G. A. McLean.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Flt. Sgt. A. W. Armstrong; P/O. G. F. Sanderson.

MISSING, BELIEVED KILLED IN ACTION.—Flt. Sgt. F. L. Darlington; Flt. Lt. G. J. O'Hanley.

MISSING.—F/O. F. C. Anderson; F/O. R. H. Bertran, D.F.C.; P/O. T. S. Briggs; Sgt. J. J. J. F. Casaubon; Sgt. E. D. Coates; Sgt. J. R. A. R. Coulombe; Sgt. E. T. Cox; Sgt. H. McK. Duke; Sgt. L. L. Gladwin; Flt. Sgt. K. J. Hodgson; Flt. Sgt. W. J. Hogg; P/O. D. McBeath; Flt. Sgt. H. R. McKay; P/O. J. M. Patterson; Sgt. L. H. Peterson; F/O. A. F. G. Ritch; P/O. C. Tuma; Sgt. L. Willis.

KILLED ON ACTIVE SERVICE.—Act. W/O. H. D. Muirhead; P/O. S. Rogers; Sgt. B. L. Sweeny.

Royal New Zealand Air Force

KILLED IN ACTION.—F/O. K. C. Johanson; Sgt. U. W. Wallace.

MISSING.—Sgt. I. F. Bailey; F/O. B. T. Connell; Flt. Sgt. J. G. Gow; Sgt. D. Harding-Smith; Sgt. L. W. Tabor; Flt. Sgt. J. H. F. Whyte.

South African Air Force

KILLED ON ACTIVE SERVICE.—Lt. E. W. Airey; P/O. R. N. Nugent.